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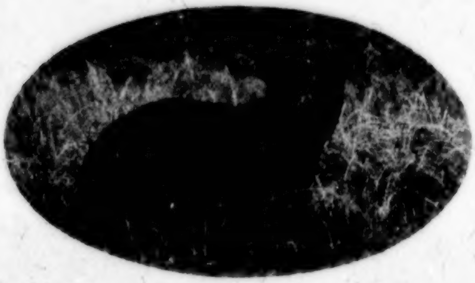
COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT PROGRAM

Annual Report
FY 1999

Education

Research

Technical Assistance



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COOPERATIVE FISH AND WILDLIFE RESEARCH UNITS PROGRAM

Annual Report

Fiscal Year 1999

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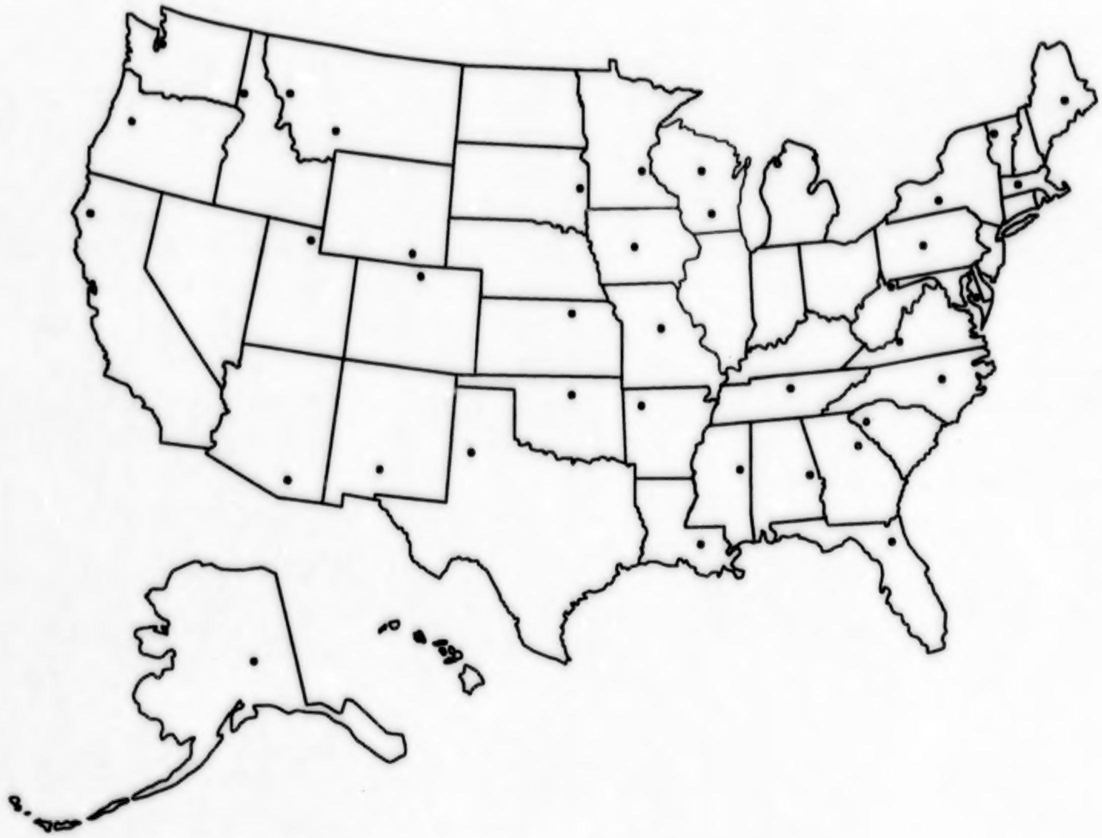
COOPERATIVE RESEARCH UNITS PROGRAM

The Cooperative Research Units Program is one of USGS's strongest links to federal and state management agencies. Each unit is a formal partnership among the Biological Resources Division of the U.S. Geological Survey, a State natural resource agency, a host university, and the Wildlife Management Institute. The structure of the program provides Federal and State agencies access not only to Unit scientists, but also to facilities and expertise available at the cooperating universities. Because scientists and university faculty members possess individual interests and areas of expertise, the program collectively embraces a wide array of disciplines related to fish, wildlife, and natural resource management in virtually every type of North American ecological community.

The first Unit was established at Iowa State College, in 1935, by J. Norwood "Ding" Darling. Darling was a visionary who recognized a dire need for biological information, trained wildlife managers, and dissemination of information to management agencies. Darling didn't quit with the establishment of the Iowa Unit, but went on to establish regional Units that facilitated development of a national program. In 1960, the Unit Program was formally sanctioned with the enactment of the Cooperative Units Act (PL 86-686). Today, there are 39 Cooperative Research Units in 37 states.



Cooperative Research Units have a three-fold mission; Education, Research, and Technical Assistance.

Education - Unit scientists teach university courses at the graduate level, provide academic guidance to graduate students, and serve on academic committees. Training of future resource professionals is accomplished through a "hands-on" approach as most research projects are carried out by graduate students participating with and/or under the direction of unit or other university scientists. The Cooperative Research Units Program also sponsors four minority education programs that focus on recruitment, training, research opportunities, and placement assistance for minority students: the Cooperative Wildlife Project at Grambling State University, the Cooperative Fisheries Project at the University of Arkansas-Pine Bluff, the Native American and Hispanic Program (directed by the Arizona Unit) and the Career Awareness Institute which is co-sponsored with the U.S. Fish and Wildlife Service.

Research - Cooperative Unit scientists conduct research that is designed to meet the information needs expressed by unit cooperators. Unit research programs are not base funded, but rather are funded by State, Federal, and non-government agencies to meet their own information needs relating to fish, wildlife, and natural resource management. Collectively, the Program conducts over 1,000 research projects and produces more than 300 scientific publications annually. Units use each individual project as a building block in constructing research programs to provide not only applied science information for management, but also to develop new techniques, scientific theory, and principles at a more basic level. The research programs conducted by units are locally approved, as directed, by the Unit Coordinating Committee overseeing each unit. Research programs and staff expertise differ widely among units, reflecting the needs of local cooperators. The research may be of local, regional, national, or international interest. The Cooperative Research Units Program participates in two major national research and monitoring programs: Gap Analysis Program and Breeding Birds. Multiple unit projects are not unusual and take advantage of the strategic geographic locations of units dispersed across the country, and the differences in expertise among different units.

Technical Assistance - Units provide technical assistance and training to State and Federal personnel and other natural resource managers, as needed. The expertise of the Cooperative Research Unit scientists, cooperating university faculty, and biologists of the cooperating State natural resource agency is made available for this aspect of the mission. Technical Assistance consists of numerous, diverse tasks ranging from participation on a task force or a recovery team to conducting workshops or symposia to writing newspaper articles. Technical assistance is provided as a one to one interaction, or to groups through workshops or short courses.

PROGRAM HIGHLIGHTS FOR FY 99

People and Events

In many ways, FY 1999 was a year of reflection on the past, and planning for the future. Major events included another strong budget year with a $1M add to the base program dollars, 24 recruitment actions, a national meeting of unit scientists focused on the future of the Unit program, a doubling of efforts to improve administrative efficiencies, a re-commitment to serving the needs of all Unit Cooperators, and an outreach effort to Unit partners. Meanwhile, Unit scientists continued their strong service to Unit Cooperators with another banner year on the teaching, technical assistance, and research productivity.

It is tempting to become complacent when the program is prospering. But this year's closure of the Ohio Cooperative Fish and Wildlife Research Unit, one of the original Units dating back to 1936, serves as a cautionary reminder that each cooperating agency must promote open communication and common program goals. The cooperative nature of the program is the essence of its effectiveness. During this year, Unit staff from across the country, have pledged themselves to improve communication and planning efforts at the national and local level, and to seek new and innovative ways to enhance Unit value to all Unit Cooperators.

The CRU program had great recruitment successes this year. Thanks to the new funding provided by Congress over the past three fiscal years, the number of unfunded Unit science vacancies has been reduced from 20 in FY 1997 to only four as the program enters FY 2000. Couple these new funds with salary recycling from people that left the Unit program, and we had quite a hefty workload just coordinating recruiting actions. This kept our Unit Supervisors, Lynn Haines, Mike VanDenAvyle, and Mike Tome actively engaged with recruitments for the entire year. Our thanks to these folks for their superior efforts in this active recruitment year. Unit Leaders reporting for duty in FY 99 were: Dr. David Krementz, AR, Dr. Stephen DeStefano, MA, Dr. Joe Margraf, AK, Dr. Tom Kwak, NC, and Dr. Mike Bozek, WI-F. Assistant Unit Leaders reporting for duty in FY 99 were: Dr. Dave Fulton, MN; Dr. Cynthia Loftin, ME; Dr. Duane Diefenbach, PA; Dr. Mike Mitchell, AL; and Dr. David Beauchamp WA. Recruitment activities initiated in FY 99 and continuing into FY 2000 include science positions in Alaska, Arizona, Arkansas, California, Georgia, Hawaii, Louisiana, New Mexico, Pennsylvania, South Dakota, Tennessee, West Virginia, Wisconsin, and Vermont. In addition to these recruitment actions, Kim Soto joined the CRU national program office as an administrative assistant.

Of course, the gate does not swing one way and the program experienced attrition in several positions. Dr. Carol McIvor left the AZ unit for a position at the Florida-Caribbean Science Center, Dr. Martin Stapanian joined the staff of the Great Lakes Science upon the closure of the Ohio Unit, and Dr. Richard Pace left the LA Unit for a position at NOAA at Woods Hole. We had four retirements during the year: Dr. Jim Johnson (AR UL); Dr. Dean Arnold (PA AUL-F); Dr. Jim Reynolds (AK UL); and Dr. Rebecca Field (MA AUL-W). We wish all of these members of the Unit family well in their new endeavors. The year also was a time of great sadness with the deaths of Dr. Don Rusch, UL WI-W in September, 1999 and Jacqueline La Perriere, AK AUL-F in October, 1999.

In February we held the first program-wide meeting of unit scientists since 1991. The meeting was held in San Diego and attended by more than 80 Unit scientists, CRU national office staff, and Unit supervisors. The meeting focused on the future of the Unit program and its strategies for meeting the challenges of the 21st Century. The plenary session included presentations and challenges by Chip Groat, Director, USGS, Rollie Sparrowe, President, Wildlife Management Institute, and Duane Shroufe, Director, Arizona Game and Fish. This was followed by four presentations: Denny Fenn, Chief Biologist, BRD spoke on the role of Units in the BRD, USGS; Dale Hall, Deputy Regional Director, Region 4 FWS spoke on the role of Units in the delivery of Federal management and conservation programs; John Kimball, Director, Division of Wildlife Resources, Utah State Department of Natural Resources spoke on the role of Units in the deliver of State management and conservation programs, and Rich Noble, Fish and Wildlife Program Coordinator spoke about the university perspective on the role of the Units in training our next generation of natural resource professionals. The remainder of the meeting was interactive, with discussions focusing on three main theme areas: 1) Maintaining and improving research support to natural resource managers; 2) Maintaining and improving support to our state and university Cooperators; 3) Unit roles in academic programs and student training. Many opinions and suggestions for program direction were voiced, but the underlying theme was that the Units and Cooperators need to communicate more effectively and work more closely for all parties to obtain maximum benefit. These discussions stimulated a re-commitment on the part of individual Units and the CRU office to enhance the Unit program's value to all Cooperators. It was gratifying to see such enthusiastic participation and interest from our program Cooperators and partners. Thanks to everyone for making this a successful event.

The Cooperative Research Units (CRU) also held an administrative workshop for Unit support staff and new unit scientists. The workshop was held in San Diego and was attended by more than 80 people. The complexities and challenges presented by state, university, and Federal administrative requirements and processes were discussed, but the majority of the workshop focused on Federal procedures. Training on Research Work Orders, travel, time and attendance reporting, budget management and record keeping, and other topics was delivered by CRU and other USGS personnel. The workshop and associated events provided opportunities for all of us in the CRU family to put faces on those voices across the country, and to get to know each other better.

Summary Statistics

The Unit program had over 1,000 active projects in FY 99 that covered a wide range of disciplines including biodiversity, instream flow, anadromous fish and migratory bird management, wetland management and restoration, wildlife disease investigations, ecotoxicology, aquaculture and fish propogation, and population genetics. Aquatic projects accounted for the largest portion of the total (35%), while terrestrial, integrative and species specific projects made up 29, 14, and 22%, respectively. More than 200 projects were completed in 1999, while approximately 180 projects were initiated to address state and federal agency needs. Thirty agencies, organizations or other entities contracted Unit research services in FY 99. The Biological Resources Division, the U.S. Fish and Wildlife Service, and State Agencies combined accounted for >70% of the projects (by number). Unit scientists, staff and students published 367 scientific papers, submitted 336 reports to management agencies, and presented 1,004 papers or workshops to natural resource professional societies and agencies.

In FY 99, the Unit program included a total of 846 graduate students. Federal Unit staff served as major advisors for 587 of these students (Unit students). The remaining 259 students had financial or other close ties to a unit, but did not have federal Unit staff as a major advisor (Affiliated students). Graduate degrees were received by 132 Unit students and 49 Affiliated students in FY 99. Overall, the three major employers of these graduates were state agencies, universities and private industry. State agencies were the largest employer of Master's graduates, but universities were the largest employer of Doctoral graduates. Of the 55 students supported by cooperative education agreements, USGS-Biological Resources Division directly funded 18% of them.

In addition to their excellent publishing record, Federal Unit Staff provided a multitude of services to professional societies, boards, and committees in FY 99. For example, federal staff reviewed over 1,300 papers and proposals, held 95 officer level positions on committees or panels, and maintained 163 committee memberships. Federal staff were also actively involved in workshop and extension activities in FY 1999 by conducting 40 workshops, 19 symposia and 35 short courses; giving 122 public lectures; and maintaining membership on 52 task forces, 14 recovery teams and 9 public panels; just to name a few!

IN MEMORY

It is with great sorrow, that we report the loss of **Donald H. Rusch** (*Unit Leader, Wisconsin*) in September, 1999 and **Jacqueline R. LaPerriere** (*Assistant Unit Leader, Alaska*) in October, 1999. Their significant contributions to the Unit program will be greatly missed by the many colleagues and students whose lives they touched. We have re-printed the text portion of their obituaries below, with the belief that the words of their loved ones are those best to share.

Donald H. Rusch

CAMBRIDGE-ROCKDALE - Dr. Donald H. Rusch, age 60, long term resident of the Cambridge-Rockdale area, suffered a heart attackon Sunday, September 12, 1999 while hunting grouse in the badlands of North Dakota with his wife and three bird-dogs. Donald was born on December 22, 1938, the son of Eanest Otto Rusch and Gertrude Bronold Rusch of Menasha, Wisconsin. He received a Bachelor's degree at the University of Wisconsin-Madison, a MS degree in Wildlife Biology from Utah State University, and a Ph.D. degree from the Department of Wildlife Ecology, UW-Madison. He began his professional career as a wildlife biologist for the Manitoba Department of Natural Resources, authoring the Manitoba Waterfowl Plan. In 1974, he accepted the position of leader of the U.S. Fish and Wildlife Cooperative Unit, joining the graduate faculty at UW-Madison. During his 25 year tenure in this position, he guided the research of numerous graduate students seeking Masters and Doctoral degrees in wildlife studies, and provided tecchnical advice and assistance to federal and state agencies. In recognition of his leadership role in goose research and management, he was awarded the U.S. Department of Interior Meritorious Service Award and the Ducks Unlimited Wetlands Conservation Achievement Award. This year he was awarded the Touchstone Award by the Wildlife Management Institute. He was the foremost living authority on ruffed grouse, and has been recognized for his many contributions. He has authored or co-authored over 140 scientific books and papers, and is internationally known for his expertise. He has served in leadership capacities in the Wildlife Society, and has professional relationships with many organizations including the Wildlife Management Institute, Ducks Unlimited, Ruffed Grouse Society, and the Mississippi Flyway Council. He is survived by his wife, Doris Ann; his daughter, Jennifer of Madison; his brother, Steven Michael of West Bend; and a sister, Judy Maertz of Pound. Funeral Serviceswill be held at 1:00 p.m. on Saturday, September 18, 1999 at GRACE LUTHERAN CHURCH, in Cambridge, Wisconsin. A gathering will follow the services. Friendsmay call from 4:00 p.m. until 8:00 p.m. on Friday, September 17, 1999 at NITARDY FUNERAL HOME, in Cambridge. In lieu of flowers, contributions may be directed to: Donald H. Rusch Memorial Fund, C/O University of Wisconsin Foundation, P.O. Box 8860, Madison, Wisconsin 53708-8860. The Donald H. Rusch Memorial Fund will be used for biological research and education.

- Text as Appearing in the Wisconsin State Journal, Wednesday, September 15, 1999

Jacqueline R. LaPerriere

Jacqueline R. Doyle LaPerriere, 56, passed away at her home surrounded by her family on October 30, 1999, in Fairbanks, after a valiant fight against a rare cancer.

Jacqueline was born in Northampton, Massachusetts, on December 31, 1942. Her parents were the late William F. and Anita R. (Tessier) Doyle of Florence, MA. She was predeceased by her sister Margot A. Doyle. She is survived by her sister Anita F. Schetzel of Monson, MA.

Jacqueline worked for the Biological Resources Division of the U.S. Geological Survey at the University of Alaska Fairbanks, as Assistant Leader of the Alaska Cooperative Fish and Wildlife Research Unit and as an Associate Professor of Biology and Wildlife, Fisheries and Water Resources.

She was educated at St. Michall High School in Northampton, the University of Massachusetts and Iowa State University, where she earned a Ph.D. in Water Resources in 1981. She was the first woman in the nation named an assistant leader of a cooperative unit by the U.S. Fish and Wildlife Service in 1980.

Jacqueline was active in several professional societies and was a volunteer to the Women in Crisis-Counseling and Assistance programs as an advocate for rape victims and provided a safe home for victims of domestic violence. She was on the first WIC-CA board, and also served later as a board member. She was a volunteer tutor at the Southside Center for high school students.

She joined the Fairbanks Curling Club in 1977 and there met her beloved husband of 16 years, Richard F. Harnois. She also leaves her two children, Monique M. LaPerriere of Missoula, Montana, and Arthur J. L. LaPerriere of Portland, Oregon. They were her proudest achievements. She also leaves her two cats Snow and Mouse.

Jacqueline will be sorely missed by her graduate students. She was a great mentor with much expertise and wisdom that she shared with her students, always mixed with her wonderful sense of humor. Her family and friends will always be comforted by the memory of her warm smile, terrific laugh and her ability to make each of us feel so special and loved.

A potlatch will be held in her honor at the Dog Mushers Hall at a later date, to be announced. Her family will scatter her ashes in favorite places in Alaska, Hawaii and the Connecticut Valley of Massachusetts.

In lieu of flowers the family suggests donations be made in Jacqueline's name to either Santa's Clearing House, P.O. Box 70710, Fairbanks, AK 99707, or Women In Crisis-Counseling and Assistance, 717 Ninth Ave., Fairbanks, AK 99701.

- Text as appearing in the Fairbanks Daily News-Miner, November 2, 1999

SELECTED ACCOMPLISHMENTS

Environmental Contaminants

For the U.S. Fish and Wildlife Service, the Arizona Cooperative Fish and Wildlife Research Unit completed a study on the effects of selenium on neotropical migrants in the riparian corridor of the Colorado River. Previous studies have shown elevated selenium levels in sediment, aquatic insects, crayfish, fish, and fish eating birds in connected backwaters along the Colorado River. This study also showed elevated levels in five species of passerine birds and their eggs; levels were near or above levels of concern. Despite elevated levels in the tissues and eggs of these species, reproductive effects were not demonstrated. Information should be useful to land management agencies along the lower Colorado River. (SIS #5001913)

For the Missouri Department of Conservation, U.S. Fish and Wildlife Service, and the Columbia Environmental Research Center, the Missouri Cooperative Fish and Wildlife Research Unit completed a study of the potential impact of environmental contaminants on the endangered Indiana bat. Based upon data from a surrogate species (little brown bat) and the distribution of Indiana bat maternity colonies in Missouri, we concluded that a high potential exists for contamination to occur from agricultural chemicals; that bats are ingesting organochlorine, pyrethroid, organophosphate, and carbamate pesticides; and that lethal dosage rates for permethrin were lower than published figures for laboratory mice. These findings provide new evidence of a potential link between the decline of Indiana bats and environmental contaminants that will be useful in developing recovery strategies. (SIS #5002251)

For the U. S. Fish and Wildlife Service, the South Dakota Cooperative Fish and Wildlife Research Unit assessed the status of the aquatic biota in Whitewood Creek where mine wastes have accumulated for many years. Biomonitoring data for fish and invertebrates was similar to that in unaffected streams except in the spring when high flows could have flushed contaminants into the stream. The study was part of a Natural Resource Damage Assessment for possible litigation. (SIS #5002508)

For the U.S. Geological Survey, the Texas Cooperative Fish and Wildlife Research Unit conducted a study to clone the estrogen receptors from yellow-legged frog and Pacific tree frog. We also obtained a partial cDNA sequence for the estrogen receptor-beta of yellow-legged frog, marking the first time the sequence of an estrogen receptor-beta is characterized in an amphibian. The data obtained will enhance basic knowledge of estrogen receptors in amphibians, particularly of species of concern where population declines have been observed. The information can be of immediate use in the design of probes for studies of the effects of environmental contaminants on estrogen receptor expression in frog tissues. (SIS #5003044)

For the Environmental Protection Agency, Texas Tech College of Engineering, Texas State Soil and Water Conservation Board, Texas Tech College of Agricultural Science and Natural Resources, U.S. Department of Energy, Western Regional Biomass Energy Program, and the Texas Tech College of Arts and Sciences, the Texas Cooperative Fish and Wildlife Research Unit completed a study of the use of duckweed to recycle nitrogen from wastewater from cattle feedlots. Our findings indicate that the duckweed species *Lemna obscura* and *Wolffia globosa* are useful ingredients in cattle rations. Furthermore, the ammonia level of wastewater decreased after duckweed was grown on this wastewater.

These findings should be valuable in designing systems using aquatic plants to recover nutrients like nitrogen from agricultural wastewater while at the same time reducing nitrogen present in that wastewater. (SIS #5003830)

A joint project between the U.S. Fish and Wildlife Service and the Wisconsin Cooperative Fishery Research Unit quantified movement of lake trout in Lake Michigan. The data are to be used to establish quantitative relations of contaminant transfer within the Lake Michigan Biota Box being developed by the U.S. Environmental Protection Agency. (SIS #5003498).

Non-game Species

For the U.S. Air Force, the Alaska Cooperative Fish and Wildlife Research Unit conducted a study on the effects of aircraft overflights on birds of prey in central Alaska. Nest-site use and nesting success of peregrine falcons and bald eagles were examined in areas where military aircraft regularly perform low altitude training flights. Site use and success were within the historically observed range of values in the area. Thus, low-level military aircraft flights had no measurable population-level impact on birds of prey in the training areas.

For the USGS/BRD, the Alaska Cooperative Fish and Wildlife Research Unit conducted a study of Pacific walrus body condition. Seasonal evaluations of the standard blubber measurement techniques revealed that walrus body condition could be adequately indexed by this technique. This will allow managers to conduct more broad-scale evaluations of condition in assessing the status of the Pacific walrus population.

For the U.S. Fish and Wildlife Service, the Alaska Cooperative Fish and Wildlife Research Unit estimated population numbers and reproductive success of common murres and black-legged kittiwakes at Bluff, Alaska in 1998. In this study, the numbers and reproductive success of cliff-dwelling seabirds were determined at an important breeding site in the Alaska Maritime National Wildlife Refuge. Values determined for 1998 were on the high-end of the historical range measured at this site beginning in 1975. The Refuge now has a numerical gauge of the success of their management efforts.

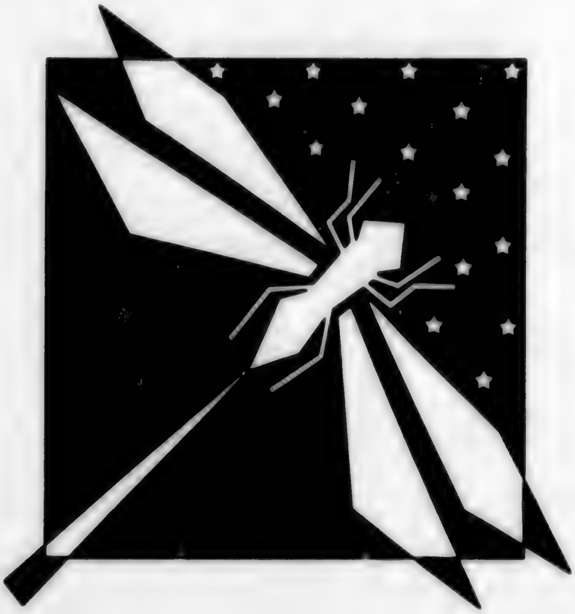
With original support from the U.S. Fish and Wildlife Service - Northern Prairie Wildlife Science Center at Dixon, and in cooperation with the U.S. Navy, the California Cooperative Fishery Research Unit completed a long-term study of brown pelicans and other marine birds at the Point Mugu Naval Air Station and at San Nicolas Island. Findings will assist the U.S. Fish and Wildlife Service in determining the population status and managing brown pelicans. (SIS #5002647)

For the National Marine Fisheries Service (in conjunction with several other public and private entities), the Florida Cooperative Fish and Wildlife Research Unit prepared a manual of research and management techniques for the conservation of sea turtles. More than 60 authors collaborated to present in a single document the latest techniques applicable to sea turtle research. This document will serve to guide global research and management of sea turtles into the 21st century. (SIS #5003333)

For the U.S. Fish and Wildlife Service, the Wyoming Cooperative Fish and Wildlife Research Unit conducted a study to test black-footed ferret development to assist in the captive rearing and release techniques. Our objectives were to: 1) determine if socialization between the mother and offspring enhances young breeding success; 2) evaluate post-copulation sperm checks; 3) compare ferret productivity under different light cycles; 4) compare indoor and outdoor rearing pens; and 5) evaluate ferret reproductivity based on reproductive history.

For the Wyoming Game and Fish Department and the U.S. Bureau of Land Management, the Wyoming Cooperative Fish and Wildlife Research Unit completed a survey of opinions and status of beaver in Wyoming. A mail survey concerning beaver management in Wyoming was sent to 5265 private-land managers and 124 public-land managers during 1993. Fifty-five percent of the private-land managers responded to the survey and supplied information on 62,859 km2 of land area and 20,037 km of streams.

Primary concerns about beaver damage centered on (in decreasing order of importance) blocked irrigation ditches, girdled timber, blocked culverts, and flooded pastures, roads, crops, and timber. Primary benefits that landowners perceive that beaver give them were, in order of importance, elevated water tables, increased riparian vegetation, and increased stock-watering opportunities. Over 45% of landowners with streams on their property and all of the public-land managers displayed an interest in a beaver reintroduction program and in more proactive beaver management.



Imperiled Species

For the White Mountain Apache Tribe and the U. S. Fish and Wildlife Service - Arizona Fisheries Resources Office, the Arizona Cooperative Fish and Wildlife Research Unit completed a study on growth and survival of juvenile Apache trout restocked into streams. Apache trout are a threatened species where several existing populations have hybridized with rainbow trout. Several of these hybrid populations have been removed and pure Apache trout stocks reintroduced. This study looked at comparative survival and growth of fish where several different reintroduction strategies were used. Information should be important to management of Apache trout. (SIS #5002634)

With support from the Trinity River Restoration Program, the California Cooperative Fishery Research Unit completed a study on summer habitat utilization by adult spring chinook salmon in the South Fork Trinity River, California. Findings show that pool surface area was the best parameter for predicting pool use. Spring run chinook salmon also preferred pools lying north-south and their densities were inversely related to the volume of pool cover. Spring run chinook salmon are listed as a threatened species and these findings will be used in defining critical habitat for the species.

For the Avon Park Air Force Range (APR), the Florida Cooperative Fish and Wildlife Research Unit completed studies of seven sensitive species on the APR. The study determined the spatial distribution of these species and defined critical habitats on the base. This work will be important for managing mission-oriented perturbations on the range by the Air Force while being responsible for their natural resources. (SIS #5003337)

For the Department of Defense - Avon Park Air Force Range, the Florida Cooperative Fish and Wildlife Research Unit, in cooperation with the Florida Game and Fresh Water Fish Commission and the United States Department of Agriculture, Agricultural Research Service, completed a spatial analysis of the impact of the non-indigenous red imported fire ant on the endangered Florida grasshopper sparrow. Our findings suggest that the spatial distribution of the fire ants was negatively correlated with the spatial distribution of grasshopper sparrows and native invertebrates. This research should be useful in understanding the decline of the Florida grasshopper sparrow, and identified a decrease in native insects as a possible mechanism responsible for the partial avoidance of grasshopper sparrows to areas of high fire and density. (SIS #5001321)

For the U.S. Army Corps of Engineers and the U.S. National Park Service, the Florida Cooperative Fish and Wildlife Research Unit monitored the endangered American crocodile in Florida Bay, Everglades National Park, Florida. The study is designed to evaluate the effects of water delivery alternatives on resident crocodiles and their habitat. In FY 99, 11 nests were found, 78 hatchlings were tagged and one non-hatchling crocodile was captured (3 captures). (SIS #5003335)

For the U.S. Fish and Wildlife Service, the Idaho Cooperative Fish and Wildlife Research Unit conducted a feasibility study on reintroduction of gray wolves to the Olympic Peninsula. We concluded that reintroduction of gray wolves to Olympic Peninsula is biologically feasible, i.e., our analysis indicated that adequate habitat and prey base exists to support a viable population of wolves over the long term. Significant increases in human population and development, and subsequent habitat fragmentation outside of Olympic National Park, may negatively impact carrying capacity for wolves within the primary analysis area, but adequate habitat and prey are likely to remain available to sustain some wolves within Park boundaries indefinitely. It is clear that wolves were culturally and ecologically important to this region; and restoration of the wolf population could have many positive aspects. We do not project significant losses to livestock or pets on the Olympic Peninsula.

The Kansas Cooperative Fish and Wildlife Research Unit evaluated the credibility of early wildlife literature about famous damaging wolves. Early accounts of cattle losses, and the length of time that individual wolves reportedly caused damage, were often exaggerated. Most famous wolves were old and physically impaired from past trap injuries or gunshots which probably contributed to them preying on livestock. Early accounts of damage by wolves should be interpreted with great caution, especially when evaluating impacts of wolf reintroductions or when modeling predation rates. Early stages of this research were supported by the Animal and Plant Health Inspection Service; data analysis and manuscript preparation were supported by the Division of Biology, Kansas State University.

For the U.S. Army Corps of Engineers, the Louisiana Cooperative Fish and Wildlife Research Unit studied the presence, abundance, and ecology of Louisiana Black Bears in the Atchafalaya Floodway project. The data will be used for assessing the impact of Army Corps of Engineers actions on a listed (esa) species. (SIS #5003649)

For the U.S. Fish and Wildlife Service, U.S. Geological Survey, and endangered species recovery teams addressing the need to enhance the production of endangered mammals, the New York Cooperative Fish and Wildlife Research Unit has developed methods that provide alternatives to surgical reproductive biotechnologies. The methods described have application to a wide range of mammals and particular utility for assisted reproduction in endangered species. The research resulted in the first live young produced by nonsurgical intrauterine embryo collection and transfer in the domestic ferret and rabbit. The results should have particular impact on small to medium sized mammals by averting the need for high-risk surgical procedures.

For a regional Fishery Bureau in China, the New York Cooperative Fish and Wildlife Research Unit identified information needs, study tasks, and options for restoring a critically endangered fish native to some large rivers of inner Asia. The U.S. Fish and Wildlife Service program to recover endangered fishes of the Colorado River will be used as a model for a recovery effort in China.

For national Atlantic sturgeon restoration efforts in Europe, the New York Cooperative Fish and Wildlife Research Unit identified the key aspects of sturgeon biology and management that need to be considered when designing restoration programs. These aspects include eight different habitats used during the life cycle of Atlantic sturgeon; and these were described in physical and temporal terms. Effective sturgeon population restoration will require very secure control of harvest over a large area, a large spatial perspective to account for the varied habitats that may be required, and a long-term perspective because restoration will likely require many decades. (SIS #5001723)

For the U.S. Fish and Wildlife Service, scientists at the North Carolina Cooperative Fish and Wildlife Research Unit released 49 captive-reared Hispaniolan Parrots in the Dominican Republic to monitor their survival and use of habitat. Our findings confirmed: 1) captive-reared birds can be translocated and released successfully (>35% survival) in forests growing in karst formations; 2) first year survival rates can be enhanced by minimizing early, post-release mortality associated with pre-release conditioning of birds, and by releasing birds between June and October; 3) mortality associated with the immediate impact of hurricane

Georges was minimal - one; and 4) reduced food availability was the leading cause of mortality. Population size of PR Parrots could be >30% greater in 10 years with the implementation of the release program than without it. Findings of this project are the basis to develop a release strategy for the endangered Puerto Rican Parrot. (SIS #5001142)

For the U.S. Fish and Wildlife Service and USGS/BRD, the Oklahoma Cooperative Fish and Wildlife Research Unit conducted a population viability analysis of the endangered Gila trout of southern New Mexico. Land use practices and fire frequency were identified as key factors influencing future loss of extant populations of Gila trout. (SIS #5003194)

For the Virginia Department of Game and Inland Fisheries, the Virginia Cooperative Fish and Wildlife Research Unit evaluated the feasibility of using re-circulating culture systems to propagate endangered freshwater mussels. Our results demonstrated that water quality and quantity could be sustained in systems with less than 300 liters of water. These systems are now in use to culture young endangered mussels for introduction into natal rivers.

For the Virginia Department of Game and Inland Fisheries, the Virginia Cooperative Fish and Wildlife Research Unit completed a study to identify the reproductive requirements of four federally endangered mussel species. Our findings determined the times of spawning and that benthic fishes were critical as hosts for their larvae. Results can be applied to the artificial propagation of these species, to achieve recovery and eventual delisting of species.

For the Wyoming Game and Fish Department, the Wyoming Cooperative Fish and Wildlife Research Unit created geographic information system (GIS) assisted guidelines for Rocky Mountain bighorn sheep reintroductions. This project developed a framework that facilitated the application of bighorn sheep transplant guidelines and habitat suitability models to GIS databases to identify and evaluate reintroduction sites for this species. The framework will also allowed the identification of sites in the Big Horn Mountains that, with specific modifications, could support sheep populations.

Game Management

For the Arkansas Game and Fish Commission and the Rocky Mountain Elk Foundation, the Arkansas Cooperative Fish and Wildlife Research Unit completed a project to study habitat use and movement of female elk, landowners' attitudes towards elk on private lands, and prevalence of meningeal worm. Research indicated elk spent most of their time feeding in open fields, used conifer patches as cover during the day, were most active during dusk and dawn, and animals captured on private lands did not return to public lands. Landowners' with elk problems, such as crop and pasture damage had negative attitudes toward elk. Prevalence of meningeal worm was low in species of snails collected. Results of this research will be useful in understanding successes and failures of reintroduced populations of elk in the east and will help Arkansas Game and Fish Commission biologists to better manage elk in Arkansas. (SIS #5001279)

In cooperation with the California Science Center and the National Park Service, the California Cooperative Fishery Research Unit completed research that establishes more precise information about elk populations at Point Reyes National Seashore, California. The data will be used in efforts to manage existing populations and to establish elk populations on public lands in West Marin County.
(SIS #5002781)

For the National Park Service - Cape Cod National Seashore, the Massachusetts Cooperative Fish and Wildlife Research Unit examined the survival and potential impacts of pheasants released for hunting in a coastal area on Cape Cod, Massachusetts. The study found: hunters took an average of 33% of released pheasants; radio-collared pheasants experienced high predation rates; and there was no evidence that released pheasants survived the fall and winter to establish a viable breeding population on Cape Cod. This study was initiated because of major controversy about the ecological impacts from release of pheasants on Cape Cod National Seashore; the results will be used by Park managers and biologists in responding to concerns from local citizens, hunters, and animal rights organizations about impacts of pheasant releases.

For the Canadian Wildlife Service, Delta Waterfowl and Wetlands Research Station, and the Edward K. Love Foundation, the Missouri Cooperative Fish and Wildlife Research Unit completed a study of the role of competition in the decline of the black duck that has taken place over the past 50 years. Our findings, based upon assessments of reproductive parameters and resource partitioning, provide strong evidence that competition with mallards has contributed to the decline of the black duck. These findings have important ramifications in developing habitat management programs and establishing hunting regulations for these species. (SIS #5002259)

In cooperation with the U.S. Fish and Wildlife Service, the Montana Cooperative Wildlife Research Unit banded ducks in prairie Canada to provide critical management information on harvest rates, age composition, migratory pathways, annual survival, and geographic derivation of the harvest.

In cooperation with the Institute for Wetland and Waterfowl Research of Ducks Unlimited, the Montana Cooperative Wildlife Research Unit conducted a sensitivity analysis to determine the relative contribution of various demographic vital rates (clutch size, renesting, nest success, duckling survival, adult hen survival during spring/summer, adult hen survival during fall/winter, etc.) to demographic performance in midcontinent mallards. Nest success was the most influential demographic rate, alone contributing nearly half of all variation in demographic performance. Together, demographic rates associated with reproduction and survival during spring and summer accounted for approximately 95% of all variation. Results from this project reinforce the importance of ongoing efforts to improve adaptive resource management for mallards by strengthening components associated with spring/summer environments and events.

For the Oklahoma Department of Wildlife Conservation, the Oklahoma Cooperative Fish and Wildlife Research Unit evaluated the effect of mesocarnivores on the ground-nesting eastern wild turkey. Despite abundant populations of coyotes, raccoons, and skunks, turkey remains were not common in predator diets. Artificial nest experiments documented substantial nest loss to predators.

For the Oklahoma Department of Wildlife Conservation, the Oklahoma Cooperative Fish and Wildlife Research Unit studied the impact of supplemental winter feeding of northern bobwhite quail in western Oklahoma. Winter climate was not a predictor of use of supplemental food, but in two of three winters, survival of bobwhites was greatest in areas with supplemental food.

For the National Park Service, the Pennsylvania Cooperative Fish and Wildlife Research Unit monitored the density and movement of white-tailed deer in Gettysburg National Military Park. Data were used to design a management plan for the deer herd. (SIS #5001736)

For the U. S. Fish and Wildlife Service, the South Dakota Cooperative Fish and Wildlife Research Unit completed an analysis of the effect of the over abundant population of snow geese on shorebirds near Hudson Bay. Our findings indicate that habitat degradation by lesser snow geese is detrimental to some shorebird species and beneficial to others. These findings help in understanding secondary and tertiary effects of the over abundant snow goose population. (SIS #5002515)

Fisheries Management

For the Alabama Department of Conservation and Natural Resources - Game and Fish Division, the Alabama Cooperative Fish and Wildlife Research Unit completed an analysis of the habitat factors influencing larval fish distribution and abundance in the Alabama and Choctawhatchee Rivers. Our findings indicate that larval fish abundance varied seasonally with hydrology and floodplain metrics and was greatest in areas where the natural periodicity of the flood-pulse regime has not been altered. These findings should be used for the establishment of stream flows in the Mobile Basin. (SIS # 5001907)

For the U. S. Army Corps of Engineers - Mobile District, the Alabama Cooperative Fish and Wildlife Research Unit completed an assessment of an improved method of confinement for grass carp used in control of aquatic plants in Lake Seminole on the Florida-Georgia border. The findings suggest that a boatable-gate combined with a low voltage electrical barrier sufficiently reduced escapement to allow control of submerged aquatic vegetation in prescribed areas. These results should prove useful for the controlled management of aquatic vegetation in specified areas of lakes and reservoirs using grass carp, and reduce the potential for detrimental affects of grass carp releases on sport fisheries and waterfowl populations. (SIS #5001270)

For the Alabama Department of Conservation and Natural Resources - Game and Fish Division, the Alabama Cooperative Fish and Wildlife Research Unit completed an evaluation of flathead and channel catfish populations in the Tallapoosa River, Alabama. Findings suggest that flow regimes impacted catfish growth rates, each species was affected differently, and catfish populations are severely below historical levels. These data should be useful for the establishment of flow regimes necessary to maintain catfish populations.

For the U.S. Fish and Wildlife Service, the Alaska Cooperative Fish and Wildlife Research Unit conducted a study of inlet contributions of ions to Becharof Lake in relation to its fisheries. In this work, 31 Becharof Lake inlet streams were characterized as to their trace element levels (signatures) and nutrient concentrations. The magnitude of nutrient input is important to fish production in Becharof Lake. Stream-borne trace element signatures now may be compared to signatures from fish otoliths (bony ear structures) to assist in determining the contributions of these streams to fish production.

For the Government of Brazil, the Arizona Cooperative Fish and Wildlife Research Unit completed a study on nitrogen transfer from a fish culture facility to an agricultural crop. Plants were very efficient at extracting inorganic nitrogen from effluent from the fish culture facility, but there was insufficient nitrogen in the effluent to provide for optimum plant growth. Efficiency of nitrogen recovery from the fish culture effluent decreased when commercial fertilizer was mixed with the effluent. This information should be useful to fish culturists. (SIS #5001931)

With support from the California Department of Fish and Game, the California Cooperative Fishery Research Unit analyzed the effects of sedimentation on incubating coho salmon in Prairie Creek, California. The findings will be used by the department, as well as National Marine Fisheries Service, in evaluating the probability for survival of coho salmon in northern California streams.

For the U.S. Forest Service, the California Cooperative Fishery Research Unit studied age, growth, and distribution of bluegill and black crappie in Ruth Reservoir, California. Findings that the size of both species was less than in other lakes and reservoirs in the region, as well as habitats each species used, will be used by the U.S. Forest Service in making sport fish harvest recommendations.

For the California Department of Fish and Game, the California Cooperative Fishery Research Unit conducted a study to test the affect of water temperature on post-angling hooking mortality in summer steelhead angled from the Mad and North Fork Trinity rivers, California. The effect of hook type and placement was also tested. This research provided valuable information for department recommendations regarding management and angling regulations.

With funding from the U.S. Fish and Wildlife Service, the Colorado Cooperative Fish and Wildlife Research Unit surveyed all states to determine what historical information exists on the occurrence and distribution of fish pathogens and parasites in wild fish. The information gathered has been incorporated into the USFWS National Wild Fish Health database and is being made available to state and federal agencies in their quest to improve the health of the nation's fish populations. (SIS #5002962)

For the National Partnership on the Management of Wild and Native Coldwater Fisheries, the Colorado Cooperative Fish and Wildlife Research Unit completed a study of the relationship of a whirling disease infected hatchery and a whirling disease positive headwater reservoir on the distribution and severity of whirling disease in the Cache la Poudre River in north central Colorado. The study demonstrated that the hatchery was the primary source of contamination in the river and that the reservoir, while being a minor source of infecting spores, contributed to the infection of almost 100% of the fish in the river. These findings helped to further understand how the disease manifests itself in a typical Rocky Mountain trout stream and will aid in the development of management techniques to combat the disease. (SIS #5001982)

For the Colorado Division of Wildlife, the Colorado Cooperative Fish and Wildlife Research Unit examined the role of environmental stressors in the survival and well-being of whirling disease infected trout in the Upper Colorado River. Laboratory and field trials indicated that elevated temperatures, gas supersaturation, bacterial cold water disease, and whirling disease were all cumulative stressors influencing the survival of rainbow trout in the Colorado River; mortality increased with each additional stressor. Fishery managers are using this information to negotiate habitat improvement projects with water developers that will lessen the severity of environmental stressors on resident fish populations and reduce the negative consequences of whirling disease in infected systems. (SIS #5001983)

For Georgia Department of Natural Resources, the Georgia Cooperative Fish and Wildlife Research Unit completed an assessment of the reproductive success of striped bass Morone saxatilis in the Chattahoochee River above West Point Lake, Georgia. Reproduction and recruitment occurred intermittently and were dependent on temperature and flows conditions in the river. Our results will help Georgia Department of Natural Resources manage the fishery for striped bass in West Point Reservoir and the fishery for stocked brown and rainbow trout in the upper reaches of the river. (SIS #5002799)

For the U.S. Army Corps of Engineers, the Idaho Cooperative Fish and Wildlife Research Unit evaluated changes in the physiological condition of juvenile chinook salmon migrating downstream in the Snake and Columbia Rivers. Total lipid reserves declined rapidly during downstream migration, falling to 61% of prerelease values for fish arriving at the first, most upstream dam (Lower Granite) and to 41% of prerelease values at the second dam (Little Goose). Declining lipid reserves during the first stages of the migration were accompanied by declining plasma triglyceride, cholesterol, and total protein concentrations, also indicating a negative nutritional balance. These results will be used, in conjunction with the results of continuing laboratory studies, to evaluate the effects of migration time and distance on the condition and viability of juvenile chinook salmon originating from the Snake River basin. (SIS #5002114)

For the Iowa Department of Natural Resources, the Iowa Cooperative Fish and Wildlife Research Unit completed an investigation of low-stress procedures for transporting juvenile walleye. The project found that physiological stress is greater while loading fish than during the transport trip; and the use of RAV-vented hauling tanks reduces the accumulation of carbon dioxide and oxygen in transport water. In addition, it is recommended that hauling trucks be equipped with oxygen meters to monitor the oxygen content of the hauling tank, and fish should be transported in 0.5% salt (NaCl) solution buffered with 0.05% NaHCO3. These findings should be valuable in reducing mortality of juvenile walleye during transport from the hatchery to the stocking site. (SIS #5002964)

For the Department of Defense, Fort Riley, Kansas, the Kansas Cooperative Fish and Wildlife Research Unit completed a study on the relationships among physicochemical habitat variables and fish community structure and function on Fort Riley Military Reservation, and also determined the influence of large-scale disturbance on instream habitat and fish assemblages. The findings indicate that large-scale disturbances in the watershed influence fish communities and instream habitat. In addition, riparian areas provide an important link between land use and instream processes.

For U.S. Fish and Wildlife Service, the Louisiana Cooperative Fish and Wildlife Research Unit documented relationships among variations in the Atchafalaya River stage, water quality, and changes in species assemblages at specific locations. Results will assist water managers in decisions regarding alteration of existing conditions in the Atchafalaya Basin. Knowledge of existing fish assemblages and the conditions under which they occur is a prerequisite in determining the benefits of water management projects to fisheries in the Atchafalaya Basin. (SIS #5003503)

For U.S. Army Corps of Engineers, the Louisiana Cooperative Fish and Wildlife Research Unit studied variation in composition and distribution of fish assemblages associated with physicochemical changes in the Buffalo Cove Management Area of the Atchafalaya River Basin. Results indicate that diverting river water is most effective at very local scales, that is, even within an area the size of Buffalo Cove. Management objectives should be specific to regions within the Unit. There would be no benefit in managing the north region for sport fishing, while it would be beneficial to promote the conservation of Lake Gravenburg for sport fishing. The findings can be used in designing future water management protocols. (SIS #5003650)

For the Maryland Industrial Partnerships Program, the Maryland Cooperative Fish and Wildlife Research Unit participated in a study designed to accomplish two objectives: (1) to determine the effectiveness of a particular strain of Phaffia rhodozyma produced and patented by IGENE Biotechnology, Inc. (Columbia, MD) for pigmenting the flesh of Atlantic salmon; and (2) to determine if incorporating this dried yeast product into Atlantic salmon feed leads to any depression in growth or histopathologies that might adversely affect the fish or consumers. It appears from the growth and histopathological data that incorporating Phaffia rhodozyma up to 10 times the amount required to elicit a flesh color change did not have any negative impacts on Atlantic salmon fed these diets and imparted the appropriate pigmentation to the flesh. IGENE has submitted these results to the Food and Drug Administration and is expecting clearance as a fish feed additive. (SIS #5003300)

For the U.S. Fish and Wildlife Service, the Maryland Cooperative Fish and Wildlife Research Unit conducted research to design a holding system to contain purged wild eel stock for a minimum period of two weeks while reducing the threat of disease and mortality. Among all three stocks held with < 1% suffering from aeromonad-induced ulcerative lesions there was a 90% survival rate. A long-term rearing system was also designed that supported survival rates of 94-100% for eels weaned onto a trout starter mash. This should give additional economic benefits to local watermen and reduce fishing pressure on the Chesapeake Bay eel population. (SIS #5003301)

Recent studies conducted by the Maryland Cooperative Fish and Wildlife Research Unit and supported by the Maryland Agricultural Experiment Station indicate that adding calcium to soft waters may mitigate the stresses of handling and transporting striped bass. Research to date indicates there is a significant positive impact on survival, blood calcium levels, and blood osmolarity when the fish were transported in water with calcium levels above 250 mg/L. Those placed in receiving waters containing either 30 or 100 mg/L calcium experienced very high mortality rates and showed greatly depressed levels of blood osmolarity and calcium. This research would indicate that the previous striped bass guidelines for aqueous calcium may, in fact, be too low and that higher levels are required for optimum survival rates. (SIS #5003303)

For the Delaware Department of Natural Resources and Environmental Conservation, the Maryland Cooperative Fish and Wildlife Research Unit observed anadromous fish using the Alaskan Steeppass fish ladder at Wagamons Pond on the upper Broadkill River in Milton, DE throughout the spring spawning migrations of 1997 and 1998. These observations were made on a schedule designed to evaluate temporal use patterns and estimated that 10,600 and 2,243 river herring used the ladder in 1997 and 1998, respectively. A bioenergetics model will be used to quantitatively assess the magnitude of predation on juvenile herring in the pond. Knowledge of the predatory impact on juvenile herring will allow fisheries managers in Delaware to determine if construction of additional fish ladders is warranted.

For USGS/BRD, the Massachusetts Cooperative Fish and Wildlife Research Unit completed a landscape and across-scale assessment of juvenile Atlantic salmon (Salmo salar) distribution and abundance in the Connecticut River. Specific objectives were to examine: (1) juvenile salmon distribution and abundance at both within basin- and watershed-scales; (2) possible relationships among juvenile production variables (survival, density, size, change in length); (3) possible relationships between salmon production and physical factors (stream order, temperature, elevation, drainage area, gradient) at both scales; and (4) the effect of scale on these relationships. Juvenile salmon do not perform equally among sites at either basin- or watershed-scales, suggesting future research and management directions that can increase the effectiveness of conservation and restoration efforts for this species.

For the U.S. Forest Service, researchers at the Massachusetts and Vermont Cooperative Fish and Wildlife Research Units, Dartmouth College, and the U.S. Forest Service completed a synthesis of past and present research on Atlantic salmon. To contribute new scientific information that can help conserve Atlantic salmon, this effort integrated 24 peer-reviewed papers that examine patterns and processes related to five broad topic areas: (a) life history; (b) space, food, and habitat use; (c) biotic interactions; (d) genetics; and (e) biophysical links and anthropogenic alterations. Together these papers were published as a 1998 Canadian Journal of Fisheries and Aquatic Sciences supplement to provide the biological basis for effective and innovative approaches that biologists, managers, and social scientists can use to develop policies that sustain Atlantic salmon and related species.

For the Cargill Fellowship, the Minnesota Cooperative Fish and Wildlife Research Unit examined a long-standing hypothesis that had not been adequately tested concerning the relation between microhabitat selection and profitability in terms of individual growth rates of three trout. The hypothesis suggests that trout select areas with slow flow to reduce energetic cost, but adjacent to faster water to increase food intake. Data were collected using underwater video recordings of brook, brown, and rainbow trout to: 1) develop time/energy budgets to quantify the amount of time trout spend on various behaviors to calculate the energetic costs associated with each behavior; and 2) monitor microhabitat use of individually-marked fish while simultaneously measuring growth using RNA/DNA ratios. Results of this study are being used by the Minnesota Department of Natural Resources and other management agencies in stream management. (SIS #5002219)

For the Minnesota Pollution Control Agency, the Minnesota Cooperative Fish and Wildlife Research Unit conducted benthic macroinvertebrate, fish, and habitat assessments at 28 sites in the Whitewater Watershed during 1996 and 1997. Project objectives were to: 1) document land use and potential types of sediment input using existing geographic information systems (GIS) databases, and perform statistical evaluation of physical and biological data in relation to land use; 2) evaluate selected sites to determine effects of stream water temperature, sediment, and substrate particle composition on fish and invertebrate community structure; and 3) evaluate potential changes in substrate composition and associated aquatic community along streams in parks, Wildlife Management Areas, and where Best Management Practices have been implemented. Results of this study are being used to recommend management and agricultural practices that minimize negative impacts to midwestern watersheds. (SIS #5002226)

For the Tennessee Wildlife Resource Agency, the Mississippi Cooperative Fish and Wildlife Research Unit identified the potential for competition among predators in Norris Reservoir. We estimated that supply-demand ratios in the reservoir averaged 3.5 and ranged from less than 1 to over 20. Given this annual fluctuation, we concluded that intensity of competition for prey among piscivores varies annually. Findings were used by the agency to solve a long-standing dispute among angler factions.

For the Montana Department of Fish, Wildlife & Parks, the Montana Cooperative Fishery Research Unit completed an evaluation of factors affecting growth of Yellowstone cutthroat trout in alpine lakes of the Absaroka Beartooth Wilderness, Montana. Our findings indicated that stocking sequence, stocking density, lake elevation, lake volume, and flushing rate correlated negatively with growth. These findings will enable State biologists to more effectively manage fisheries of alpine lakes.

For the U.S. Fish and Wildlife Service, the Montana Cooperative Fishery Research Unit completed an evaluation of habitat use of juvenile salmonids in Ophir and East Ophir creeks, Alaska. Our findings indicated that the differences in fish production rates in these streams could not be attributed to summer habitat conditions and therefore may be related to overwinter survival. These findings will facilitate the restoration effort for coho and sockeye salmon in these streams. (SIS #5002270)

For the U.S. Forest Service, the Montana Cooperative Fishery Research Unit completed an evaluation of ecology and habitat requirements of juvenile steelhead trout in southeast Alaska. Our findings indicated that steelhead used tributary habitat with more cobble and boulder substrates whereas coho salmon selected habitat with more pools, undercut banks, and large woody debris. These findings will enable forest managers to improve salmonid nursery stream production in Alaska.

For the U.S. Fish and Wildlife Service, the Montana Cooperative Fishery Research Unit completed an evaluation of the effects of fish predation on status of Arctic grayling at Red Rock Lakes National Wildlife Refuge, Montana. Our findings indicated that fish predation contributed to the mortality of Arctic grayling at the Refuge, but was probably not the cause of the recent decline of the population. These findings will enable Refuge personnel to more effectively manage the Refuge's aquatic resources. (SIS #502264)

For USGS/BRD, the Montana Cooperative Fishery Research Unit completed an evaluation of growth and survival temperature criteria for bull trout. Our findings indicated that the optimum temperatures for growth and health of this species are 12-16° C, and 20.8° C is the ultimate upper incipient lethal temperature. These findings will enhance the ability of biologists and land managers to insure that stream temperatures are maintained conducive to survival of this threatened species. (SIS #5002966)

For the National Partnership on the Management of Wild and Native Cold Water Fisheries, the Montana Cooperative Fishery Research Unit completed an evaluation of effects of age, dose, and environmental stress on development of whirling disease in rainbow trout. Our findings indicated that the development of whirling disease and survival was affected by both age at first exposure and parasite dose; fish exposed after nine weeks post-hatch became infected but did not exhibit disease symptoms. These findings will enable fishery biologists and hatchery managers to manage around whirling disease in their systems. (SIS #5002267)

For the Idaho Department of Fish and Game, the Montana Cooperative Fishery Research Unit completed an evaluation of recruitment of rainbow trout in the Henrys Fork of the Snake River, Idaho. Our findings indicated that recruitment was limited by poor juvenile survival during winter; and that this was related to dam discharges during the latter half of winter. These findings will enable fishery biologists to enhance recruitment and abundances of rainbow trout in this popular recreational fishery through dam release manipulation. (SIS #5002265)

For the U.S. Fish and Wildlife Service and the Oklahoma Department of Wildlife Conservation, the Oklahoma Cooperative Fish and Wildlife Research Unit assessed the demographic and genetic status of the Arkansas River speckled chub and attempted to reintroduce it in parts of the Arkansas River where it no longer occurs. Genetic differentiation is apparent among populations. (SIS #5003526)

For the U.S. Army Corps of Engineers, the Oregon Cooperative Fish and Wildlife Research Unit finished determination of behavior and fate of juvenile salmonids entering the tailwaters of lower Columbia River dams. This work indicated that spill patterns and locations were critical to establishing where in the tailrace chinook and coho salmon smolts migrated; this greatly affected their vulnerability to predation. This information was useful in determining dam operation procedures. (SIS #5002321)

For the U.S. Army Corps of Engineers, the Oregon Cooperative Fish and Wildlife Research Unit evaluated the migration and survival of juvenile salmonids following transportation. The project discovered that chinook salmon and steelhead trout barged around Snake and Columbia river dams essentially suffered no mortality in the lower 150 miles of the river following their release. However, there was substantial mortality experienced by the smolts in the lower estuary attributable to large colonies of piscivorous birds such as Caspian terns and double crested cormorants. The Unit completed this project as lead to a multiagency approach to relocation efforts of the bird colonies as well as identification of mortality source previously unknown. (SIS #5002320)

For the Pennsylvania Fish and Boat Commission, the Pennsylvania Cooperative Fish and Wildlife Research Unit completed a study on the population characteristics of an unexploited walleye population that is the primary source of walleye eggs for the state's propagation program. Results are being used to manage this important population of walleyes. (SIS #5001734)

For the Pennsylvania Power and Light Company, the Pennsylvania Cooperative Fish and Wildlife Research Unit determined the relation between river discharge, habitat variables, and fish occurrence in the Susquehanna River. Data will be used to design more efficient fish surveys of large rivers.

For the South Carolina Department of Natural Resources, the South Carolina Cooperative Fish and Wildlife Research Unit completed an analysis of habitat requirements and movements of striped bass in a coastal river in the ACE Basin National Estuarine Research Reserve. Our findings indicate that striped bass location within the river is highly dependent on water temperature. Striped bass are using the headwaters for thermal refuge during the hot summer months and the lower reaches of the river near the estuary during fall through spring. These findings will be used by the Department in evaluating the effectiveness of current management regulations.

The Tennessee Cooperative Fishery Research Unit completed two studies for the Tennessee Wildlife Resources Agency on the fate of rainbow trout and brown trout stocked into two large reservoir tailraces, the Caney Fork River and the South Fork of the Holston River. Low dissolved oxygen concentrations, the absence of minimum flow criteria, and unusually high spring discharges in the Caney Fork River resulted in poor survival, low rates of return, and slow growth for both trout species. Trout fared much better in the South Fork of the Holston River, where an aerating labyrinth weir dam, minimum flow criteria, and the use of autoventing turbines resulted in excellent trout growth and survival, high standing crops, and significant amounts of natural reproduction. The results are currently being used to lobby for improvements in water quality releases at Center Hill Dam, and to establish regulations in the South Fork of the Holston River to protect large trout and incubating eggs during the winter spawning season. (SIS #5002358)

For the Tennessee Wildlife Resources Agency and Tennessee Valley Authority, the Tennessee Cooperative Fishery Research Unit completed a long-term, intensive study of the response of a reservoir fish community to water level fluctuations. Six years of field sampling and laboratory analyses clearly demonstrated the profound response of within- and between-year variation in water levels on the recruitment of important sport fish such as largemouth bass and crappies, and forage species such as threadfin and gizzard shad. The information is being used by the funding agencies to lobby for changes in the guide curves regulating water levels and to de-emphasize the efficacy of small-scale habitat manipulations that are undertaken to promote sport fish recruitment. (SIS #5002354)

For the Utah Reclamation, Conservation, and Mitigation Commission through Utah Division of Wildlife Resources, the Utah Cooperative Fish and Wildlife Research Unit determined that predation on juvenile salmonids by large cutthroat trout was the primary limitation to production of gamefishes in Strawberry Reservoir. The seasonal food supply of invertebrates (both zooplankton and benthic macroinvertebrates) remained in excess of the consumption demand by all life stages of cutthroat trout, rainbow trout, and kokanee. Predation losses of juvenile trout were very severe for trout stocked in fall at a size of 50-75 mm total length, representing ~95% of the stocked fish. Predation was much less severe on trout stocked in spring due to the larger size of juveniles (> 125 mm total length) at stocking, and spawning activities that diverted potential predators away from juveniles in the reservoir. This information can be used to optimize stocking strategies (timing, number and size released) to enhance survival and growth of juveniles while operating within the production capacity of the hatchery system. (SIS# 5002369)

For the Forest Science Laboratory, U.S. Forest Service in Juneau, AK, the Utah Cooperative Fish and Wildlife Research Unit quantified predation by resident cutthroat trout on sockeye salmon fry in Margaret Lake, Alaska. After building a fish ladder around a historically impassable waterfall, a sockeye salmon population was established by stocking 30-50- mm fry in the lake in May. By combining directed sampling on diet and distribution of predators with a bioenergetics model, we determined that predation by resident cutthroat trout accounted for 50-100% of the fry mortality observed over the first growing season. Alternative stocking strategies (mass mid-day release in one area versus release at midnight after a 2-week acclimation period in large, deep net pens) did not lessen predation mortality. We concluded that the predation demand was too severe to achieve sufficient smolt production and survival for a sustainable fishable population of sockeye salmon in this system; and the program was terminated because of these analyses.

For the USDA Forest Service under the Fish Habitat Program in California, the Utah Cooperative Fish and Wildlife Research Unit studied the early life history and egg-to-fry survival of kokanee in Lake Tahoe. Egg-to-fry survival differed dramatically between two consecutive years (1.5 % and 15%) with low survival corresponding with high incubation temperatures in the fall. Fry emergence timing was also affected tremendously by fall incubation temperatures: fry emerged in January-February when fall temperatures were high, but emerged in March-May during "normal" fall temperatures. We calculated that annual survival rates for kokanee during 3.5 years of lake residence probably ranged 30-50%. This information is useful for modeling the food web dynamics of Lake Tahoe and for managing the kokanee population that supports a popular fishery and provides an important food supply for overwintering bald eagles in the Lake Tahoe basin.

For the Utah Reclamation, Conservation, and Mitigation Commission through Utah Division of Wildlife Resources, the Utah Cooperative Fish and Wildlife Research Unit studied the natural reproductive potential of Bear Lake cutthroat trout in Strawberry Reservoir. Based on a combination of growth experiments in enclosures in littoral and limnetic regions of the reservoir and in the stream, and estimates of first year survival of the migrant fry in the reservoir, we determined that migrant fry grew faster and survived better than the more abundant "resident" fry which delayed entry into the reservoir for 1- 2 years. We discovered that a key limitation to natural reproductive potential was that less than 10% of the mature cutthroat trout actually migrated to spawning tributaries. These results helped identify some key limitations to natural salmonid reproduction potential and provided guidance for altering stocking strategies to significantly enhance spawning success in the basin. (SIS# 5002365)

Supported by Sportfish Restoration Act funds from Utah Division of Wildlife Resources, the Utah Cooperative Fish and Wildlife Research Unit studied the effects of predation and stocking mortality on survival of juvenile cutthroat trout in Bear Lake. Stocking programs to sustain native cutthroat trout in Bear LakeUT-ID, have resulted in much lower than expected survival to spawning traps and to the fishery. We determined that cannibalism by larger cutthroat trout (>350 mm total length), and predation by non-native lake trout consumed over 50% of the juvenile cutthroat trout stocked, and that most predation occurred during the first month following stocking. This program identified predation as a major source of mortality for recruiting Bear Lake cutthroat trout, and managers are considering whether to continue stocking lake trout in light of their impact on the native cutthroat trout. Since lake trout do not exhibit significant reproduction in Bear Lake, terminating the lake trout stocking program would reduce mortality of cutthroat trout by 50% as older lake trout died or were harvested.

Supported by the vice president for research at Utah State University and the Berryman Institute, the Utah Cooperative Fish and Wildlife Research Unit, experimentally determined the effects of prey size, light, and turbidity on reaction distances of lake trout to salmonid prey ranging from 55-139 mm in total length. Reaction distances increased dramatically over a narrow range of light intensities (0.18-17.8 Lux), then remained relatively constant or declined slightly as light increased beyond the threshold at 17.8 Lux. Reaction distance declined exponentially with increasing turbidity. Prey size did not affect reaction distance over the range of light (0.18-250 Lux) and turbidity (0.09-7.4 NTU) conditions used in these experiments. These results helped in constructing a visual foraging model for pelagic piscivores which predicted prey encounter rates for predators located at any depth in the water column at any time of the day or night, for any combination of light and turbidity condition. (SIS #5002369)

For the Virginia Department of Game and Inland Fisheries, the Virginia Cooperative Fish and Wildlife Research Unit completed a study of variation in population characteristics of American eel from sites throughout the Potomac River drainage of Virginia. Our results indicate that eel length, age, and ratio of females to males increase with distance from the ocean. These findings will assist fish managers in developing appropriate harvest regulations and monitoring protocols.

For the Fisheries Division of the U.S. Fish and Wildlife Service, the Virginia Cooperative Fish and Wildlife Research Unit developed a stepwise procedure to quantitatively assess the adequacy of forage fish abundance to meet the demand of piscivorous sportfishes in lakes and reservoirs. Our results identified prey surpluses or deficiencies in order to adjust sportfish populations accordingly, through harvest or stocking strategies. These findings are intended for use by fisheries managers who wish to maintain balance between predator and prey populations in lakes and reservoirs.

For the Wisconsin Department of Natural Resources, the Wisconsin Cooperative Fishery Research Unit assessed limitations to walleye growth rates in an experimental lake in northern Wisconsin. Walleyes appear to be prey limited and thus regulations that help increase prey abundance would be needed to increase growth.

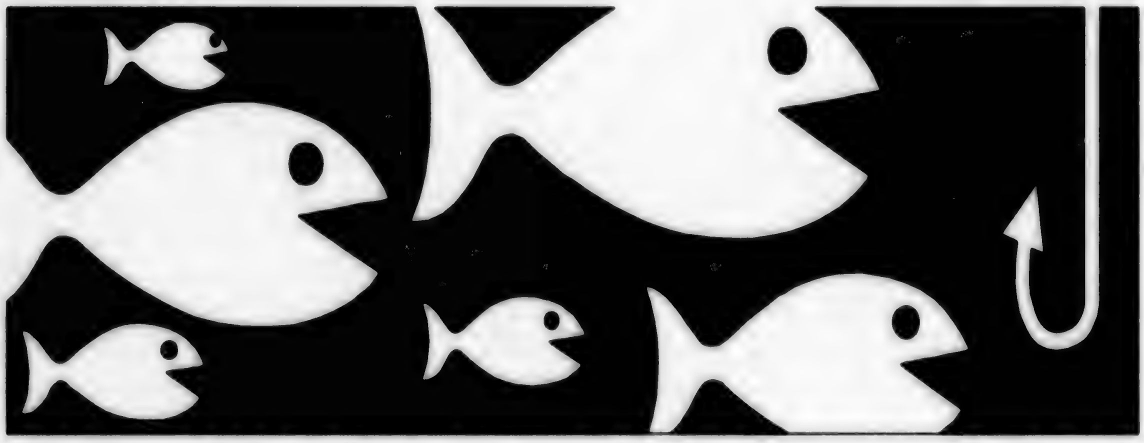
For the Wisconsin Department of Natural Resources, the Wisconsin Cooperative Fishery Research Unit validated safe harvest models for walleye that are co-managed between the Wisconsin Department of Natural Resources and the Great Lakes Indian Fish and Wildlife Commission. Walleye management now can be based on a quantified and validated model to set harvest quotas. (SIS #5002573)

For the Wisconsin Department of Natural Resources, the Wisconsin Cooperative Fishery Research Unit created models to forecast year-class-strength of walleye for standardized fall YOY surveys. Models show increased precision when lake classifications are used and are being considered for future use in allocating walleye resources between the Wisconsin Department of Natural Resources and the Great Lakes Indian Fish and Wildlife Commission. (SIS # 5002571)

For the Wisconsin Department of Natural Resources, the Wisconsin Cooperative Fishery Research Unit evaluated fish population size and size structure for bass and bluegill after aquatic plant removal. Fish responses were density-dependent following plant removal and application of results requires objective-specific planning for future use.

For the Wyoming Game and Fish Department and the U.S. Forest Service, the Wyoming Cooperative Fish and Wildlife Research Unit completed a study of the distribution of wild Yellowstone cutthroat trout in Wyoming, which currently occupy <10% of their native range. The project was designed to determine where genetically pure, wild Yellowstone cutthroat trout occur in the Greybull, Shoshone, and upper Yellowstone River drainages in Wyoming. Yellowstone cutthroat trout were hybridized extensively with rainbow trout in the North and South Fork Shoshone and Clarks Fork drainages. Genetically pure populations were found in five locations. The results will be used in development of a conservation plan for the subspecies.

For the Wyoming Game and Fish Department (WGFD), the Wyoming Cooperative Fish and Wildlife Research Unit completed an analysis of the Soda Lake Watershed. Soda Lake is where the WGFD maintains its brook stocks of brook trout and brown trout. Die-offs of trout have been observed periodically during ice-off in the spring. The goal of this project was to ascertain the management activities that will protect Soda Lake water quality and maintain the integrity of the brood stocks and sport fishery. A detailed assessment of water quality in the watershed and lake has been completed.



Ecosystem Management

For the U.S. Fish and Wildlife Service, the Alaska Cooperative Fish and Wildlife Research Unit conducted a systematic evaluation of long-tailed voles in Southeastern Alaska. The results indicated that some of the various recognized sub-species of long-tailed voles have broader geographic distributions in Southeastern Alaska than originally thought, particularly those found on the islands of the Alexander Archipelago. From this research, ecosystem-level management plans for federal lands in this region can now take advantage of an increased understanding of small mammal distribution patterns.

For the Missouri Department of Conservation, the Missouri Cooperative Fish and Wildlife Research Unit characterized pre- (1929-1948) and post-regulation (1967-1996) discharges for 11 locations along least-altered, inter-reservoir, and channelized sections of the Missouri River. Flow regulation was associated with a reduction in magnitude and duration of the annual flood pulse, an increase in magnitude and duration of annual discharge minima, a reduction in frequency of annual low-flow pulses, and a general increase in frequency of flow reversals. Hydrologic alterations were smallest at two least-altered upper-basin sites and most frequent and severe in inter-reservoir and upper-channelized river sections. We have recommended changes in reservoir operations to more closely approximate the 1929-1948 flow regime for establishing a simulated natural riverine ecosystem. (SIS #5003738)

For the Missouri Department of Conservation, the Missouri Cooperative Fish and Wildlife Research Unit evaluated the possible effects of proposed flow regulation on river biota of two western-Missouri prairie streams. Rivers were investigated as to possible differences in fish and invertebrate communities, and this information was related to regulated versus non-regulated situations. Habitat specific sampling of the biota was used to examine species response to water levels. Results indicate substantial possible effects from proposed flow regulation on invertebrate biomass and juvenile fishes. Results will be used in discussions with neighboring states on transboundary river issues. (SIS #3002230)

Animal Biodiversity, Surveys and Monitoring

For the Arizona Department of Environmental Quality, faculty from the School of Renewable Natural Resources at the University of Arizona and the Arizona Cooperative Fish and Wildlife Research Unit completed a project on invertebrate (algal) diversity as an indication of aquatic habitat quality. It was hypothesized that streams that differed in frequency of exposure to environmental stress would show differences in algal communities, but the data did not support this hypothesis. Streams had similar communities of algae regardless of their levels of exposure to contaminants or disturbance. This information should be useful to agencies contemplating the use of algal communities as indications of water pollution history in desert areas. (SIS #5001932)

For the National Park Service, the Sonoran Desert Field Station (formerly the Arizona Cooperative Park Studies Unit) and the Arizona Cooperative Fish and Wildlife Research Unit completed a study on inventory techniques for small mammals and herps on Tonto National Monument. This project identified the number of observer days it would take to get information on abundance of amphibians, reptiles, and mammals on Tonto National Monument. Time requirements were often prohibitive for this type of analysis. Detecting trends in species richness was more efficient. Information should be of interest to management agencies that need to monitor wildlife populations.

For the USGS/BRD, the Colorado Cooperative Fish and Wildlife Research Unit assembled a national database for bat population monitoring data for use by research and management people in North America. The project terminated with a conference on bat monitoring held in September 1999 in Estes Park, Colorado. (SIS #5001980)

For the U.S. Fish and Wildlife Service, the Colorado Cooperative Fish and Wildlife Research Unit examined banding and recovery data for all species of birds where >30 years of continuous data were available. From these data, we estimated long-term trends in survival probability and estimated components of variance. These results have already found use by several management agencies and research groups. (SIS #5001979)

For the Merritt Island National Wildlife Refuge, the Florida Cooperative Fish and Wildlife Research Unit examined waterfowl survey data collected for decades. Inconsistency and absence of statistical rigor make use of the current survey data very limited. The Refuge and Unit are working together to define more reliable techniques for assessing the waterfowl use of this very complicated refuge. (SIS #5003052)

For the National Marine Fisheries Service, the Florida Cooperative Fish and Wildlife Research Unit determined movement and distribution patterns, habitat use, growth rates, and carrying capacity for sea turtles in the Bahamas. Results from this project will be used by the Bahamian government to assess habitats and designate foraging locations for protected area status for the conservation and management of sea turtles.

For the U.S. Army Corps of Engineers, the Idaho Cooperative Fish and Wildlife Research Unit compared avian and small mammal use of natural and managed habitats adjacent to four lower Snake River reservoirs in Washington. We compared avian abundance, richness, and diversity among three riparian habitats in summer, fall, and spring during 1997 and 1998. Using multivariate analysis of variance, we found that avian abundance and species richness were higher at irrigated HMUs than other habitats in all three seasons combined. Species richness was highest in the fall, followed by spring; and species diversity was highest in summer, indicating that species were more evenly abundant in summer, compared to fall and spring. Our data demonstrate that habitat perturbations can be partially mitigated by habitat enhancement and management. (SIS #5002108)

For the U.S. Geological Survey and the National Park Service, the Idaho Cooperative Fish and Wildlife Research Unit examined the potential effects of controlled vehicle traffic on the 130 km Denali Park road. Using 19 large viewsheds, we examined the distribution of moose, caribou, and grizzly bears with respect to specified distances from the park road. We found that as presently managed, traffic volume and disturbance did not have an effect on the number of animals of any of the species sighted within any of the distance zones away from the road. Likewise, the effect of strata and thus the decrease in vehicle traffic also had no apparent effect on animal distribution by either species or sex and age class. Wildlife distribution along the road corridor was more keyed to habitat characteristics than any other factor. (SIS #5002089)

For the U.S. Geological Survey, the Idaho Cooperative Fish and Wildlife Research Unit's final report for the Idaho Gap Analysis project is in draft form. Comparison of results from the Gap Analysis conducted with 200 ha minimum mapping unit and those achieved using 2 ha minimum mapping unit surprisingly showed no major differences in the acreages of mapped cover types that were identified as underrepresented in nature reserves. (SIS #5002082)

For the U.S. Geological Survey, the Idaho Cooperative Fish and Wildlife Research Unit completed the aquatic Gap Analysis project. Workshops were held and formal guidelines developed for pilot projects in three states. (SIS #5002084)

For the U.S. Fish and Wildlife Service and the U.S. Geological Survey, the Iowa Cooperative Fish and Wildlife Research Unit tested potential roadside survey methods for the rare Henslow's sparrow in Iowa, Indiana, and Ohio. Surveys in June-July detected more singing males than May or August surveys, and morning surveys were most efficient. Abundant local populations, though, can be detected throughout the day. These findings should be valuable for designing range-wide surveys for this species, which is not well surveyed by the North American Breeding Bird Survey. (SIS #5002080)

For the U.S. Fish and Wildlife Service, the Iowa Cooperative Fish and Wildlife Research Unit completed a 5-year survey (1994-1998) of resident breeding birds at Neal Smith National Wildlife Refuge in Iowa - one of the largest tallgrass prairie reconstruction projects of its kind in the nation. Among 91 summer resident bird species found on the refuge, 26 species, characteristic of Iowa grassland and savanna vegetation communities, increased in frequency of occurrence over the 5-year study. Six of the 26 species showed a corresponding increase in abundance. (SIS #5001478)

For the U.S. Fish and Wildlife Service, the Louisiana Cooperative Fish and Wildlife Research Unit collected Gap Analysis Project data to help statewide and larger area conservation planning. (SIS #5001491)

For USGS/National Wetlands Research Center, the Louisiana Cooperative Fish and Wildlife Research Unit provided data on current breeding distribution, habitat use, and nest chronology of Common Moorhens, Purple Gallinules, King Rails, and Clapper Rails. This data will be used to support the Fish and Wildlife Service migratory birds assessments of status and trends. (SIS #5003325)

For the USGS/BRD, four sites on Delaware Bay were selected by the staff of the Maryland Cooperative Fish and Wildlife Research Unit for sampling horseshoe crab eggs. A total of 2,094 samples were collected from the four beaches. Horseshoe crab eggs were first observed on May 13, two days after the new moon and peak egg counts occurred in June. More eggs were found at depths of 15-20 cm than at 0-5 cm. This study of temporal and spatial patterns of egg deposition will lead to greater understanding of the success and failure of various horseshoe crab spawning beaches.

For the Maryland Department of Natural Resources - Fisheries Service and USGS/BRD, the Maryland Cooperative Fish and Wildlife Research Unit began a 2-year study in 1996 to quantify the temporal and spatial patterns of horseshoe crab use of spawning beaches. Horseshoe crabs were sampled at high tides from May through August 1996 and 1997. There appeared to be an increasing trend in the average density of spawners on the days preceding full and new moons, and a plateau in spawning activity on the days immediately following full and new moons. Our analysis suggests that to maximize repeatability of index values, sampling should be done on the higher of the two daily high tides, one or two days immediately following new or full moons from mid?May through July, concentrating on counting at the waters edge.

For the Maryland Department of Natural Resources and Coastal Zone Management, the Maryland Cooperative Fish and Wildlife Research Unit conducted an ecological evaluation of Maryland's coastal bays and facilitated the development of biological protocol for site selection of spoil disposal areas based on fish, shellfish, and other ecologically and environmentally important factors. Based on preliminary data analysis from the first three years of the study, Maryland's coastal bays have species complexes and water quality conditions typical of high-quality Mid-Atlantic estuaries. Over 250,000 specimens representing 116 species were taken in 1722 collections made in 32 months of study. The biological criteria will be available to evaluate the impact of future projects on the natural resources within Maryland's coastal bays. (SIS #5001516)

For Tudor Farms, Inc., the Maryland Cooperative Fish and Wildlife Research Unit radio-collared and tracked nutria at Tudor Farms in Cambridge, MD, from August 1995 to March 1998. Population estimates ranged from 18,000 to 22,000 nutria for the three years of the study; and hunters killed about 22% of the population per year. No significant difference was observed in male and female home ranges or linear net displacement in a 24-hr period and home ranges of the animals overlapped. This study will help managers to more completely understand nutria behavior and population dynamics.

For the U.S. Fish and Wildlife Service, Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources, NCASI, and the U.S. Forest Service, the Minnesota Cooperative Fish and Wildlife Research Unit, conducted two projects. These projects reviewed past and present research activities to develop a framework for research and monitoring of northern goshawks in the western Great Lakes Region. There are considerable conservation concerns for northern goshawks in the southwestern U.S., the Pacific Northwest, and southeast Alaska. In the western Great Lakes Region, northern goshawks are considered a sensitive species by the U.S. Forest Service, and have been considered by several states for listing as species with special status. Project results are being used by state and federal conservation and management agencies to develop strategies for goshawk management and research. (SIS #5003735)

For the National GAP Analysis Program of USGS, the Missouri Cooperative Fish and Wildlife Research Unit completed the GAP Analysis for the State of Missouri. During the course of this work, digital databases were completed for land cover, state and federal land ownership, predicted vertebrate distributions, and relationships between areas of high species richness and protection status. These data will be used locally and nationally for the protection and preservation of biodiversity. (SIS #5002255, #5002256, and #5002257)

As part of the Breeding Biology Research and Monitoring Database (BBIRD) of USGS/BRD, the Missouri Cooperative Fish and Wildlife Research Unit conducted 15 point counts each (3 visits each) and monitored nesting success in 10 study sites in two regions of Missouri-central forest fragments and the unfragmented Ozarks-during the period 1991-1999. In this cooperative venture involving over 15 Units, an attempt was made to acquire detailed data on avian populations, reproductive success, and habitat use using consistent protocols at all locations. Detailed habitat measures following the BBIRD protocol were made both within the general habitats and at each of several hundred monitored nests. Data were submitted to the national BBIRD database and have been analyzed as part of several separate publications detailing patterns of abundance and demography in these two areas of Missouri. (SIS #5002234)

For the Missouri Department of Conservation, the Missouri Cooperative Fish and Wildlife Research Unit developed a protocol for sampling catfish in northern prairie streams. This protocol standardized deployment and timing of sampling units. From an evaluation of three different gears, the hoop net saturation set used during the fall of the year was shown to be the most predictable and precise. Results offer to managers a proven technique with known precision to use for population assessment of catfishes. (SIS #5002238)

For the U.S. Army White Sands Missile Range, the New Mexico Cooperative Fish and Wildlife Research Unit collected soil, vegetation, and wildlife data as part of the Land Condition Trend Analysis (LCTA) program. Data for 1988-1997 were summarized for a comprehensive program perspective on 507 LCTA plots previously installed and monitored. Problems related to field methodologies and compilation of animal-related field data limit analytical use. Future LCTA data collection and compilation should focus on consistent and well-documented inventory data and routine summary reporting. The 10-year summary provides researchers with a baseline to assess future comparisons and to organize fire management research regarding plant communities and associated wildlife. (SIS #5002460)

For the U.S. Army White Sands Missile Range, the New Mexico Cooperative Fish and Wildlife Research Unit described migratory and resident bird occurrence across a landscape of about 800,000 ha of Chihuahuan Desert basins and shrublands, montane coniferous woodland, and scattered riparian areas during spring, summer, and fall 1996-1997. From 4,200 point counts in 10 vegetation communities, mist netting, wetland observations, and raptor nesting surveys, we detected 225 bird species by all methods, including 58 species that had not been confirmed previously for this large, restricted area. Conservation enhancement involves minimizing disturbances to arroyos used by migrant birds. Bird detection records from this research should be used to prepare a checklist for staff education and use during public visitation to historic and natural areas on the installation. (SIS #5002461)

For USGS/BRD, a faculty collaborator with the New Mexico Cooperative Fish and Wildlife Research Unit performed statistical analyses that detected positive trends in peregrine falcons *Falco peregrinus* counted and captured at Assateague Island, MD-VA. Fall counts and captures also revealed an increase in numbers of birds at Padre Island, Texas. Monitoring peregrine migration at these two sites may be a cost-effective method for monitoring the status of peregrine falcons. (SIS #5002466)

For the Montana Fish, Wildlife and Parks, Boone and Crockett Club, Cinnabar Foundation, Pope and Young Club, Safari Club International, U.S.D.A. Forest Service Intermountain Research Lab, U.S. Fish and Wildlife Service, and the U.S. Geological Survey, the New York Cooperative Fish and Wildlife Research Unit completed a mountain lion study that included aspects of environmental, biological, and human dimensions of this important species. We used a combination of ecological and social science methods to determine: 1) factors that influence the distribution and abundance of mountain lions; (2) vital statistics that most affect lion population growth; and (3) factors that determine stakeholder attitudes about lion populations. A broadly-based assessment model was developed that included lion population trends, attitudes toward lions, beliefs and risk perception issues, environmental factors including prey items, habitat and cover types, and the inherent population viability of the cat itself. Management reports, scientific papers, and recommendations to individual states and their associated federal counterparts will offer guidance and meaningful solutions to a host of issues relative to the lion. (SIS #5002825)

For the South Dakota Department of Game, Fish and Parks, the South Dakota Cooperative Fish and Wildlife Research Unit determined the status of anurans (frogs and toads) in South Dakota. Four species had distributions similar to historical records, five were more widely distributed, and four had lesser distributions. A full color booklet was produced to improve public knowledge about the identity and habitat needs of frogs and toads. (SIS #5002488)

For the Wyoming Game and Fish Department and the Grand Teton National Park, the Wyoming Cooperative Fish and Wildlife Research Unit completed a study on avian habitat ecology within the riparian corridor of the Snake River, Grand Teton National Park, Wyoming. Surveys were conducted during the summers of 1996 and 1997 on 56 transects. Comparisons were made between bird utilized and non-utilized habitat components in six habitat types. Habitat use was determined for three scales of resolution: microhabitat, intermediate (0.04 ha), and landscape. Of the 77 avian species observed within the riparian corridor, 68 (88%) decreased in abundance due to human influence. Predatory and nest parasitic species have increased in abundance throughout the region. Detrimental effects from those species from habitat alteration and attraction could seriously effect songbird populations. Dynamic structure of the Snake River from periodic flooding also influenced avian assemblages. No single avian species was favored due to multi-aged habitat stands.

For the U.S. Fish and Wildlife Service, the Wyoming Cooperative Fish and Wildlife Research Unit completed a study on common snipe habitat, surveys, and evaluation of the Breeding Bird Survey. Common snipe numbers in North America are unknown, in part, because no survey technique to monitor their numbers has been developed. We developed and evaluated three indices to abundance (point count, call count, and winnow count) to monitor snipe trends. We identified six factors (season, time of day, lunar cycle, solar radiation, wind speed, and temperature) that effect snipe behavior. We evaluated four labor-intensive techniques (territorial/spot mapping, flush counts, tape playback territorial mapping, and nest searches) to estimate numbers of snipe or their territories. Territorial/spot mapping most accurately represented the number of territories present, followed by flush counts, tape playback territorial mapping, and nest searches, in that order. We identified four habitat characteristics (soil moisture, water depth, distance to nearest shrub cover, presence and dominance of herbaceous plants (sedges)) that were important for snipe and evaluated the BBS for snipe, since doubts about the use of this technique exist. Our results suggest the BBS is not a useful technique for monitoring snipe trends.

Habitat Management and Restoration Ecology

For the Alabama Department of Conservation and Natural Resources - Game and Fish Division, and Auburn University, the Alabama Cooperative Fish and Wildlife Research Unit completed a study of the population dynamics and habitat use of Alabama beach mice. The results indicate that sex ratios of mice were even and did not differ among the study areas; population densities varied seasonally, but were on average similar among areas; and bimonthly survival rates of adults varied from 0.52 - 0.59. These results should be useful for the development of Habitat Conservation Plans for the conservation of beach mouse populations.

For the Arizona Game and Fish Department, the Arizona Cooperative Fish and Wildlife Research Unit has completed a study on effects of desert waterholes (both natural and man made) on the distribution of small mammals, reptiles, and birds. Controversy exists over whether desert waterholes (especially those that are man made) benefit, are neutral to, or harm native desert wildlife. This study showed that native bats of several species benefited from water holes. This information should be useful to agencies determining whether to develop or maintain waterholes in desert areas. (SIS #5002635)

For the Bureau of Reclamation, faculty from the School of Natural Resources at the University of Arizona and the Arizona Cooperative Fish and Wildlife Research Unit have completed a project on mitigation and movement corridors for large mammals along the Tucson aqueduct. The Tucson Mitigation Corridor was purchased by the Bureau of Reclamation to provide a movement corridor across the CAP aqueduct between the Tucson Mountains and the Tohono O'odham Reservation. Deer crossed the aqueduct more often within than outside the corridor, but coyotes crossed more frequently outside the corridor. Crossings used most frequently had proximity to water catchments, higher forage quality, and more vegetation. The findings should be of interest to land management agencies that have future management plans to create and develop wildlife movement corridors. (SIS #5001911)

For the Arizona Game and Fish Department, the Department of Soil, Water and Environmental Science at the University of Arizona and the Arizona Cooperative Fish and Wildlife Research Unit completed a study of use of blowdown water to establish salt tolerant plants for use by wildlife. Disposal of blowdown water from power plants is a significant environmental problem. This study investigated whether blowdown water could be used to establish and grow halophytes and whether these plants were then used by wildlife. The study showed that plants became established and were used by wildlife. This information should be of use to entities producing highly saline wastewater streams. (SIS #5001930)

For the Panther National Wildlife Refuge, the Florida Cooperative Fish and Wildlife Research Unit conducted studies on the effects of fire management on forage at the refuge. The study provided important information on fire frequency in various habitats on a variety of species. The fire management plans of the refuge will be altered to accommodate the finding of this study, providing improved habitat conditions for white-tailed deer, a key prey for the endangered Florida panther. (SIS #5003334)

For the U.S. Army Corps of Engineers, the University of Florida has conducted research aimed at restoration of wading bird populations to the Everglades. This project discovered that less than 30% of adult wading birds in the Everglades are actually breeding, which is considered a very low proportion. The research focused on comparing breeding and nonbreeding birds in their nutritional condition, hormonal profiles, plumage, and contaminant loads in order to distinguish between varied hypotheses concerning their nonbreeding condition. This work has led to the development of safe and efficient trapping techniques for adult wading birds, specific knowledge of movements of breeding birds within the Everglades, and detailed information about reproductive hormonal cycles in both wild and captive birds. This information should be valuable for assessing whether the proposed hydrological restoration will result in restoration of these key vertebrates to the Everglades system.

For the U.S. Geological Survey, the Idaho Cooperative Fish and Wildlife Research Unit compared riparian conditions in grazed and ungrazed pastures on the Little Pend Oreille National Wildlife Refuge, Washington. Shrub cover and the number of forb/grass or shrub species present did not differ significantly between grazed and ungrazed pastures. Although a slightly greater number of plant communities were observed in ungrazed than grazed pastures, variability among sites was high and these differences were not significant. These results suggest that changes in riparian vegetation may not be apparent in the first few years following the removal of livestock.

For Idaho Fish and Game, the Idaho Cooperative Fish and Wildlife Research Unit radio-tagged and monitored 73 mountain quail *Oreortyx pictus* from October 1994 through March 1995, and 40 quail from September 1995 through February 1996 along drainages of the Little Salmon River in Idaho County. Our objectives were to: 1) describe characteristics of habitat used by the birds in fall and winter; 2) determine daily and seasonal movements and home range size of radio-marked quail during fall and winter; and 3) determine survival rates of mountain quail over the fall and winter. Microhabitat variables associated with mountain quail fall and winter use sites were proximity to water, taller shrubs, more visual obstruction, and greater vegetative canopy cover than random sites. This suggests that shrub canopy cover may be limiting for mountain quail in Idaho. During the fall and winter of 1994/95, mountain quail experienced over-winter loss of 47%, but during the fall and winter of 1995/96, when the heaviest snowfall was later in the winter, over-winter loss was 75%. Management activities to enhance winter cover and food sources at low elevations could improve survival rates during harsh conditions.

For the U.S. Army Corps of Engineers, the Idaho Cooperative Fish and Wildlife Research Unit completed a literature review to assemble information on habitats, biota, and habitat associations in John Day Reservoir, Washington. Potential effects on the habitat and biota of drawdown to 220 and 165 ft MSL were projected based on existing information. A number of studies should be conducted in riverine areas, like the Hanford Reach, to provide technical support for these interpretations. Studies such as examination of changes in the fish community, species interactions, and changes in predator abundance and efficiency could be conducted in surrogate reaches to provide greater technical support for these projections. (SIS #5003343)

For the U.S. Geological Survey, the Iowa Cooperative Fish and Wildlife Research Unit completed an examination of effects of field size on population density and nest success of birds nesting in Conservation Reserve Program (CRP) fields in west-central Minnesota. There was no effect of field size over the range of sizes considered 9-124 hectares. In this range, field characteristics and landscape context may have larger effects than size. These findings should be useful to managers of small parcels of grassland and for evaluating conservation benefits of the CRP and similar federal programs.

For the U.S. Fish and Wildlife Service and U.S. Forest Service, the Kansas Cooperative Fish and Wildlife Research Unit completed a study on plant and bird communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado. The findings indicate that while prairie dogs readily influence bird communities in the shortgrass prairie region, their influence is quite different from what has been reported from northern mixed-grass prairie. These findings will allow land managers and conservationists to make informed decision regarding the management of western rangelands that contain or could potentially contain prairie dogs.

For U.S. Army Corps of Engineers, the Louisiana Cooperative Fish and Wildlife Research Unit completed 3-D maps and models of the East Grand Lake area showing that 70% of the sedimentation that has occurred in the Basin took place by the early 1980's. While a larger amount of sediment has accrued near the top of the original Grand Lake since the early 1900's, the lower regions have filled, resulting in a diminished gradient (decreased from 2 inches/mile to 0.5 inch/mile). This has increased stagnation in the Basin's swamp units and has exacerbated a growing hypoxia problem after each flooding cycle. Knowledge of increased sedimentation and reduced gradient has application in all models and management scenarios being developed for habitat restoration (water movement, purging accrued organic materials, increasing dissolved oxygen) efforts in this floodplain river-swamp Basin. (SIS #5003328)

For the U.S. Fish and Wildlife Service - Wallkill River National Wildlife Refuge, the Massachusetts Cooperative Fish and Wildlife Research Unit evaluated habitat associations of grassland birds and impacts of grassland use and management practices. A total of 103 birds were recorded in grassland sites on the Refuge; grasshopper and savannah sparrows preferred larger grasslands with extensive bare ground. Bobolinks were associated with taller, drier grasslands. Although there were no significant associations between bird use and land use practices, birds tended to avoid grazed and mowed sites. The results of this study will help refuge biologists and managers determine the characteristics and land-use patterns of grasslands for the benefit of grassland birds.

For the U.S. Fish and Wildlife Service, the Minnesota Cooperative Fish and Wildlife Research Unit evaluated the effects of the Grass Lake wetland restoration on migratory birds. One of the primary justifications for restoring wetlands through the North American Waterfowl Management Plan program is to provide benefits to migratory birds and other wildlife. Wetland restoration at Grass Lake (Minnesota) and the Eagle Lake wetland complex (Iowa) affords a unique opportunity to evaluate and monitor response of migratory birds to wetland restoration. At Grass Lake, preliminary bird surveys were completed in 1998, and a monitoring protocol was developed and provided to the U.S. Fish and Wildlife Service. Project results will be used as a baseline to compare future use of this area by migratory birds following restoration. (SIS #5002224)

For Region 6 of the U.S. Fish and Wildlife Service, the Missouri Cooperative Fish and Wildlife Research Unit completed an analysis of how rest-rotation grazing by cattle during the growing season impacted the structure and richness of wetland vegetation within montane habitats of the San Luis Valley, Colorado. Our findings indicate that rest-rotation grazing during the growing season reduces the robust structure of short emergent vegetation, but the results are strongly influenced by local hydrology. These findings provide guidance for the intensity, timing, and hydrologic conditions associated with grazing required to meet specific habitat-based objectives for wildlife. (SIS #5002233)

A research project on avian productivity in riparian forests has been conducted for the USDA Forest Service, Rocky Mountain Research Station and the University of MT/Cooperative Wildlife Research Unit. All data has been collected for the final phase of the project, and four papers have been submitted to peer-reviewed journals detailing our findings regarding the effects of landscape modification on birds nesting in deciduous riparian forests (2 in review, 2 published). This last phase of work has finalized our data on the demographic impact of cowbirds and predators on two riparian nesting species with different life-histories, the American Redstart *Setophaga ruticilla* and the Yellow Warbler *Dendroica petechia*. These data will be used to construct a demographic model to estimate population status for these species.

A research project on avian productivity in burned forests has been conducted for the USDA Forest Service, Rocky Mountain Research Station and the University of MT/Cooperative Wildlife Research Unit. Preliminary findings indicate that responses (in terms of nest success and nest-site selection) to salvage logged post-fire forests were variable among nine cavity-nesting birds species. Most species selected attributes of unlogged areas for nesting. Results from this study will be published in peer reviewed scientific journals and be made available to land managers.

For the American Fisheries Society and the U.S. Fish and Wildlife Service, the New York Cooperative Fish and Wildlife Research Unit authored a book called "Aquatic Habitat Assessment: Common Methods" that provides a synthesis of the most widely used methods for aquatic habitat assessment in North America. Sixteen method chapters detail step-by-step procedures for assessing and describing regional setting, basin attributes, waterbody identification, stream reaches, macrohabitat, substrate, cover and refuge, bank condition, riparian vegetation, barriers, stream discharge and volume, water velocity, temperature, lake morphometry, and optical and chemical properties. The purpose of this book is to reduce the variability in approaches to habitat assessment, while still providing flexibility for selecting practices that vary in effort, precision, and detail. (SIS #5001720)

For the US Army, XVIII Airborne Corps and Ft. Bragg, North Carolina, the North Carolina Cooperative Fish and Wildlife Research Unit compared bird communities occurring in longleaf pine habitat subjected to grown season fire to those in habitats in which fire had been suppressed. Species belonging to an upland longleaf pine assemblage (e.g. Red-cockaded woodpecker, Bachman's sparrow) were more common in burned areas, as were species belonging to a drain assemblage (e.g., Carolina wren, White-eyed vireo). A third set of species (e.g., Acadian flycatcher, Red-eyed vireo) were uncommon and restricted to drains in burned areas, but more common and more widely distributed in unburned areas. Species in the final assemblage (Summer tanager, Great-crested flycatcher) were widely distributed and unaffected by burn treatment. Overall, results suggest that growing season fire benefits most bird species characteristic of longleaf pine communities. The exceptions are species that are normally rare and restricted to drains in these communities, which are able to increase and spread into the uplands in the absence of fire. (SIS #5001138)

In cooperation with the Pennsylvania Department of Environmental Protection, the Pennsylvania Cooperative Fish and Wildlife Research Unit assessed the effects of urban runoff on benthic invertebrates. Results are being used to help develop a stormwater management plan for the Spring Creek watershed. (SIS #5002472)

In cooperation with the U.S. Fish and Wildlife Service, the South Carolina Cooperative Fish and Wildlife Research Unit conducted a pilot study designed to test various field-sampling designs for assessing the impacts of recreational shrimp baiting activity on the waterbird community on Cape Romain National Wildlife Refuge. Locations of recreational boats and their proximity to foraging and loafing shorebirds and wading birds were recorded at stratified tide stages and times of day. These data provided insight into the behavior ecology and spatial/temporal variation in bird use of the refuge, and will serve as the basis for improved sampling designs for a longer term study on the ecology and disturbance of the bird community at this important East coast migratory bird refuge. (SIS #5003131)

For the Wildlife Conservation Society, The Zoological Society of London, and the International Livestock Research Institute, the Utah Cooperative Fish and Wildlife Research Unit studied a large-scale ecotone in Omo National Park, Ethiopia to determine the hierarchical nature of the types and scales of constraints that govern system development. Specifically, we investigated the concept that larger scale constraints should override smaller scale constraints to the extent that one should be able to predict vegetation distribution and pattern. Our results confirm that rainfall is major predictor, but that topography and edaphic conditions provide the smaller scale context for plant distribution and pattern. These findings add to the growing literature about how landscapes develop.

For the U.S Fish and Wildlife Service, the Wyoming Cooperative Fish and Wildlife Research Unit completed a study on avian use of riparian habitats in an urban to rural gradient in Salt Lake Valley, Utah. In the 1995 and 1996 breeding seasons, the avian assemblages and vegetative structure of five riparian habitat types across 17 sites were studied in an effort to assess: 1) the diversity, distribution and species composition of the Jordan's avian assemblages as a baseline for restoration; 2) the potential result if one of three habitat types targeted for restoration is selected; and 3) the effects of matrix habitat (e.g., the degree of upland development) on the composition of the riparian avian assemblage. Ungrazed willow habitats with rural uplands were the most rich in avian species of greatest regional concern and should be preferentially targeted for restoration in this urban context. Critical factors affecting restoration site selection are: site position within the migratory landscape, dominance by exotic vegetation, human disturbance within the riparian corridor, and flood control efforts of the past century.

For the Wyoming Game and Fish Department (WGFD), the Wyoming Cooperative Fish and Wildlife Research Unit completed a project that evaluated habitat and spatial use patterns of sympatric black bears and grizzly bears in the Togwotee Pass area of northwestern Wyoming. The project took advantage of and complimented an ongoing grizzly bear project conducted by the WGFD. Results should allow agencies to consider both bear species when they are sympatric.

For the U.S. Forest Service and the Wyoming Game and Fish Department, the Wyoming Cooperative Fish and Wildlife Research Unit completed a study on the factors affecting the relative use of northern goshawk kill areas in southcentral Wyoming. We examined four factors that could affect the relative use of goshawk kill areas: 1) prey abundance, 2) habitat characteristics, 3) landscape patterns, and 4) habitat needs of prey species. The relative use of kill areas was more frequently correlated with habitat characteristics than prey abundance. Goshawks returned most often to sites with more mature forests, gentler slopes, lower ground coverage of woody plants, and greater densities of large conifers. In addition, goshawks returned most often to kill sites that were closer to nests, had greater coverage of conifer, and greater densities of small natural openings in 1 km circles around kill sites.

Biometrics and Modeling

This research was funded by the U.S. Fish and Wildlife Service, as part of the FWS National Wetlands Inventory program. The Colorado Cooperative Fish and Wildlife Research Unit determined the best statistical method to use for making temporal projections of wetlands status based on the extant Status and Trends sample data (at about 3,600 four square mile sample plots, with data for the 70's, 80's and early 90's on 14 wetland types). The projection method obtained is presented in the main product, a Ph.D. dissertation in statistics by Dr. Gerardo H. Herrazas-Gonzales, Evaluation of projection methods to predict wetlands areas: the wetlands inventory of the USA. Other products are SAS programs for analysis of the wetlands Status and Trends data, including software for temporal projections. (SIS #5001982)

For the USGS/BRD, the Colorado Cooperative Fish and Wildlife Research Unit analyzed the extensive striped bass tag recovery and recapture data on the eastern U.S. coast. The Unit determined that recent models for joint live-dead data would not help or be applicable. However, modified models for these data are needed due to a potential bias induced by release of live fish after tag removal. Correction methods were devised and are given in a draft scientific paper by Smith, D. R., K. P. Burnham, D. M. Kahn, X. He, C. J. Goshorn, K. A. Hattala, and A. Kahule, Estimating Atlantic striped bass survival from tag-recoveries: assessment of bias due to tags recovered from live recaptures and application of model averaging. (SIS #5001977)

For the US Geological Survey, the Idaho Cooperative Fish and Wildlife Research Unit completed a review of the ecological literature that indicated the information needed to adequately model the habitats of most wildlife species is unavailable. For twenty species of interest to Idaho Department of Fish and Game, only the game species had information adequate to model wildlife habitat in any detail. (SIS #5002985)

For the Iowa Department of Natural Resources (IDNR), the Iowa Cooperative Fish and Wildlife Research Unit investigated landscape factors associated with pheasant populations. Field data and modeling show that populations in landscapes with large blocks of Conservation Reserve Program (CRP) grasslands are able to recover relatively quickly from periodic declines due to snowy cold winter weather. Modeling also shows that landscapes with lots of edge, like those dominated by practices like the USDA buffer initiative, cannot sustain pheasant populations as dense as those found in landscapes with at least 10% of the area in blocks of CRP. (SIS #5002965)

For the Iowa Department of Natural Resources (IDNR) and the Iowa Department of Transportation (IDOT), the Iowa Cooperative Fish and Wildlife Research Unit investigated deer-vehicle accidents on Iowa roadways. A literature survey evaluated different technologies designed for reducing deer-vehicle accidents (DVAs), and data on DVAs were incorporated into a geographic information system (GIS) and combined with Gap Analysis Program landuse data to develop a statistical model using landscape factors to predict DVA sites. Results of this study have been provided to the IDNR and IDOT for the purposes of management and road planning. Finally, a large-scale controlled experiment was designed to test a multi-technology approach to reducing DVA's, and this design has been provided to IDOT and the IDNR, as well as other governmental and private-sector groups that may be interested in funding the research. (SIS #5002803)

For the Massachusetts Division of Fisheries and Wildlife, the Massachusetts Cooperative Fish and Wildlife Research Unit obtained population estimates and survival rates to build a model to assess white-tailed deer populations in eastern Massachusetts. We radio-collared and monitored 35 deer during winters 1997-99; and adult deer density estimates and cause-specific mortality data were incorporated into the model. Estimated numbers of adult deer harvested each year agreed favorably with harvest data, suggesting that density and mortality estimates from the telemetry data were reasonable and thus could be incorporated into the Division's herd and harvest management strategies.

For Patuxent Wildlife Research Center of the U.S. Geological Survey as part of a larger project for linking population viability models to management strategies, a faculty collaborator with the New Mexico Cooperative Fish and Wildlife Research Unit used a variance-components approach to partition the total variability of an estimated parameter. He demonstrated how sampling variation can be removed from the observed total variation of parameter estimates. Substantial differences in observed significance levels were observed when testing for demographic differences in temporal variation using temporal variance estimates adjusted and unadjusted for sampling variance. By removing sampling variability from estimates of temporal variability, less biased estimates are available to managers as well as population modelers. (SIS #5002275)

For the Pacific Flyway Waterfowl Council, U.S. Fish and Wildlife Service Office of Migratory Bird Management, Ducks Unlimited, Inc., and the California Waterfowl Association, the New York Cooperative Fish and Wildlife Research Unit completed quantitative models for the adaptive harvest management of North American pintail ducks and western mallards. These models integrate information from a variety of monitoring programs to evaluate population responses to harvest regulations and environmental conditions. Model sets were then developed that provide a framework for making objective decisions about future management actions for these species. (SIS #5002824)

For the U.S. Geological Survey and State Natural Resource Agencies, the New York Cooperative Fish and Wildlife Research Unit completed and tested a set of river basin geographic information system (GIS) models to predict relative levels of fish and macroinvertebrate diversity and identify stream reaches having high biodiversity that are without management or protection. The modeling procedures have potential as coarse, but feasible, methods to identify high biodiversity habitats that should receive priority conservation attention at the watershed scale. (SIS #5002822)

For the U.S. Fish and Wildlife Service, the North Carolina Cooperative Fish and Wildlife Research Unit developed a deterministic and stochastic version of a wild turkey population model. This was placed on the World Wide Web to make it accessible to any turkey biologist with a PC, internet connection, and web browser. The model is very user friendly, and will be useful in setting hunting regulations. (SIS #5001167)

For the U.S. Forest Service and the Oklahoma Department of Wildlife Conservation, the Oklahoma Cooperative Fish and Wildlife Research Unit developed a geographic information system (GIS)-based habitat assessment model for the black bear in the Ouachita National Forest of Oklahoma. Black bears are moving from Arkansas into Oklahoma and colonizing former range; the best habitat in Oklahoma is in relatively unpopulated areas, minimizing the potential for bear-human interactions.

For the National Sea Grant Program, the Oregon Cooperative Fish and Wildlife Research Unit completed an analysis of the distribution of alien benthic invertebrates that have become established in Yaquina (high ocean cargo traffic) versus Alsea (no ocean cargo traffic since 1920) bays. At least 12 aliens versus have become established in Yaquina Bay vs. 7 in Alsea Bay. Three species, *Hobsonia florida*, *Pseudopolydora Kempi*, and *Nippoleucon hinumensis* are among the ten most abundant species in the benthic assemblages. Qualitative mathematical modeling suggests that the benthic communities did not become unstable although they are less stable than before aliens became established. (SIS #5002306)

For the Pennsylvania Game Commission and the West Virginia Division of Natural Resources (in cooperation with the West Virginia Cooperative Fish and Wildlife Research Unit), the Pennsylvania Cooperative Fish and Wildlife Research Unit developed broad-scale models to identify areas of potential American woodcock habitat across large geographic areas.

For the USDA Forest Service Rocky Mountain Research Station, the Utah Cooperative Fish and Wildlife Research Unit examined the ability of generalized additive models (GAMs) to delineate forest structural diversity in the Uinta Mountains, Utah. Based on the assumption that vegetation composition, as well as structural diversity, is a function of environmental gradients, spatial models of temperature, precipitation, elevation, aspect, slope, and geology were included as independent environmental variables. Spatially explicit probability maps were generated for presence of forest, presence of lodgepole pine, basal area of forest trees, percent cover of shrubs, and density of snags. The maps were validated using an independent set of field data collected from the Evanston Ranger District within the Uinta Mountains. Models predicting the presence of forest and lodgepole pine were 88% and 80% accurate, respectively, within the Evanston Ranger District, and an average 62% of the predictions of basal area, shrub cover, and snag density fell within an approximate 15% deviation from the field validation values. (SIS #5002372)

For the Institute for Natural Systems Engineering, Utah State University, the Utah Cooperative Fish and Wildlife Research Unit examined validation of an individual-based, mechanistic habitat selection model for drift-feeding salmonids. A net energy intake (NEI) model developed by Addley (1995) for cutthroat trout was tested by applying it to brown trout and mountain whitefish in a stream to determine the generality of this model for drift-feeding salmonids in other waters, and its applicability to stream fishes that were not primarily drift-feeders (e.g., mountain whitefish). When compared to the actual distribution of fish, the model was very accurate at predicting the number and locations of feeding stations occupied by trout of various size classes in the stream during both summer and winter flow and temperature conditions. This approach will be useful for estimating how changes in streamflow and temperature will affect the useable habitat and production potential for a variety of salmonids in streams.

Other

For the National Park Service, the Alaska Cooperative Fish and Wildlife Research Unit assessed the sea-level history in the Icy Strait area of Glacier Bay National Park. The study found that sea level has fluctuated widely over the past 13,000 years. Even as recently as 400 years ago, sea level has been as much as 11 meters higher than at present. Archaeological researchers now know that at sites less than 11 meters above present sea level, the archaeological record will be restricted to the last 400 years.

For the U.S. Forest Service, the Alaska Cooperative Fish and Wildlife Research Unit conducted a study of national projects of forest productivity under climate change. This study evaluated the regional economic responses of the global forest sector to a range of climate change scenarios associated with different trajectories of global emission controls. The Forest Service now has the capability to assess how international protocols to control the growth of atmospheric carbon dioxide may influence the world's timber trade and to evaluate the potential economic consequences for the U.S. timber sector. (SIS # 5003100)

For the USGS/BRD, the Arizona Cooperative Fish and Wildlife Research Unit completed a study on impacts of discarded or lost fishing tackle on water birds. Discarded or lost fishing tackle, particularly lead sinkers, have been identified as a danger to water birds in several waters across the country. Results indicated that discarded fishing tackle was present at high densities in only a few waters and in only localized areas of these waters. These data should help in deciding whether the use of lead sinkers should be regulated nationally or on a local basis. (SIS #5001908)

For the USGS/BRD - Forest and Rangeland Ecosystem Science Center, the California Cooperative Fishery Research Unit coordinated a research project to establish an annual climatology of lake thermal structure (1991 - 1994) for Crater Lake, Oregon, develop calibration coefficients for thermistors, and generate a time series of temperature estimates in the lake from data collected between 1995 and 1997. The final products of the data processing include temperature, conductivity, pressure, depth, salinity, density, and transmissivity values averaged into 2m bin depths. (SIS #5003105)

For the U.S. Geological Survey, the Idaho Cooperative Fish and Wildlife Research Unit used geographic information systems (GIS) to correlate fire ignition patterns from 1980-1996 with vegetation cover-types, precipitation, and topography within portions of five semi-arid ecoregions in the western U.S. The methods used in this study provide fire managers with a procedure that can be applied at a variety of spatial scales. The procedure is flexible enough to allow the incorporation of improved vegetation maps and several other variables that may be important in evaluating fire danger at more local scales. A large number of municipalities were identified as priorities for fire danger planning, especially in the suburban areas surrounding the major western population centers. (SIS #5002091)

The Idaho Cooperative Fish and Wildlife Research Unit conducted work on the FDA approved registration of erythromycin for treatment of bacterial kidney disease. The work completed from 1995-1999 produced submission and publication of five peer reviewed publications, and submission and acceptance of four major compilations of data to the US Food and Drug Administration, Center for Veterinary Medicine. (SIS #5002102)

For the US Geological Survey, the Idaho Cooperative Fish and Wildlife Research Unit completed an assessment of the distribution of nature reserves in the conterminous United States. The percentage of area in nature reserves was greatest in areas of poor soil and high elevation. The area in nature reserves increased from eastern to western United States with less than 2% of Bailey's Eastern Humid Domain in reserves, 7.8% of the Dry Domain in reserves, and 12.7% of Western Humid Domain in reserves. Sixty percent (range 86-48%) of the mapped cover types in eight states had less than 10% of their area in nature reserves. Land ownership patterns indicate that the overwhelming percentage of land at lower elevations with the highest soil productivity were in private ownership. (SIS #5002807)

For the Idaho Bureau of Land Management, the Idaho Cooperative Fish and Wildlife Research Unit compiled a bibliography that encompasses most of the published scientific literature on mountain quail up to November 1998. References vary from critical scientific studies to those making casual reference to quail. Species lists referring to mountain quail and books on wildlife are the newest editions.

For the U. S. Fish and Wildlife Service - Conte National Fish and Wildlife Refuge, the Massachusetts Cooperative Fish and Wildlife Research Unit compared two wetlands rapid assessment methods: the landscape-level (subbasins) Synoptic Approach from the Environmental Protection Agency; and the larger-scale (individual wetlands) method developed by Ammann and Stone. Using the two methods in combination was found to be cumbersome and impractical; applying a geographical information system (GIS) at the landscape scale using the Synoptic Approach proved more useful. This study was initiated because of the needs of Refuge staff to assess quickly and efficiently the many wetlands within the watershed of the Connecticut River; results will help Refuge staff throughout the watershed in evaluating wetlands for acquisition or protection.

For the U. S. Army Corps of Engineers, the Montana Cooperative Wildlife Research Unit developed and produced a manual for application of the Hydrogeomorphic Approach to assessment of wetland function of alluvial floodplain riverine wetlands in the Northern Rocky Mountain Region. An instructional workshop on application of the approach was also held for state, tribal, and federal personnel. (SIS #5001631)

For the U.S. Air Force Bird-Aircraft Strike Hazard program, the New Mexico Cooperative Fish and Wildlife Research Unit analyzed data from eight turkey vultures (Cathartes aura) in North Carolina equipped with pressure-sensor transmitters through the ARGOS Data Collection and Location System satellite network. Analysis showed that weather variables, modeled by the USAF Atmospheric Slant Path Analysis Model (ASPAM), bore no relationship to vulture flight altitudes. Vultures generally were non-migratory and flight altitudes varied seasonally with the greatest altitudes during June through August. Monthly average data suggest that USAF low-level training flights in this area, between 1000 and 1800 Zulu (0500 to 1300 Eastern Standard Time, should be minimized between the surface and 300 feet (91.4 m) above ground level to reduce the risk of aircraft-turkey vulture collision. (SIS #5002465)

For the U. S. Fish and Wildlife Service, the South Dakota Cooperative Fish and Wildlife Research Unit developed a method to locate areas of protected and unprotected wetlands in eastern South Dakota. Most unprotected wetlands are <0.5 ha in size and occurred in the James River Lowland physiographic region. These findings will assist the agency in planning fee-title acquisition and the conveyance of easements to better protect waterfowl habitat.

The Wisconsin Cooperative Wildlife Research Unit worked with personnel at the U.S. Army Construction Engineering Research Laboratory (USACERL) to assess the vegetation at Fort Hood, Texas. Preliminary fieldwork was accomplished and color orthophotos have been registered to a Landsat TM scene. A computer-assisted classification of the habitat has been accomplished and sent to personnel at CERL as well as Ft. Hood. Change detection algorithms have been designed and will be implemented when additional funding is available. (SIS #5003160)

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Vacant, AUL Fish

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PROGRAM STATISTICS

Overall

Table 1. Percentage of Cooperative Research Unit projects by selected categories, for fiscal year 1999.

	Aquatic	Terrestrial	Integrated	Species specific	Total
USGS-Biological Resources Division	26	35	23	16	100
Other Agencies	33	32	14	21	100
Other	41	23	10	26	100
Combined Total	***35***	***29***	***14***	***22***	***100***

Table 2. Number of projects sorted by agencies, organizations, and other entities contracting for research services in fiscal year 1999.

Agency or organization	Number	Agency or organization	Number
USGS-Biological Resources Division	200	Native American agency	4
Bureau of Land Management	10	Non-governmental Conservation Org.	58
Bureau of Reclamation	8	Other[1]	32
City or County Government	9	Private Industry or Organization	29
Department of Defense	40	State Agencies	394
Department of Energy	1	U.S. Army Corps of Engineers	31
Foreign Government or University	6	U.S.D.A. (other than Forest Service)	4
National Fish and Wildlife Foundation	2	U.S. Environmental Protection Agency	21
National Marine Fisheries Service	7	U.S. Fish and Wildlife Service	195
National Oceanic and Atmospheric Admin.	13	U.S. Forest Service	55
National Park Service	26	U.S. University	31
National Science Foundation	7		

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[1] Each of these agencies or organizations had one project reported unless noted otherwise in parentheses: U.S. Geological Survey Water Resources Division (2); Pacific Flyway Council; Mississippi Flyway Council; Private Fellowships (13); Hudson River Foundation; Natural Partnership on Management of Wild and Native Coldwater Fisheries (6); Vermont Military; National Center for Ecological Analysis and Synthesis; U.S. AID; North Atlantic Treaty Organization; Bonneville Power Administration (2); and state governments (2).

Table 3. Number of publications and presentations of professional papers with co-authorship by Federal Unit staff or by others affiliated with the Unit in fiscal year 1999.

Author / coauthor	Papers published		Papers presented[2]
	Journals, books & symposia[1]	Technical & semi-technical	
Federal Unit Staff	256	248	634
Non-federal unit staff and students	111	88	370
Total	*367*	*336*	*1004*

[1] Includes only symposia with recognized publication series such as Transactions of the North American Wildlife and Natural Resources Conference.

[2] Does not include lectures provided as part of seminar series at universities.

Students

In the following Tables, Unit students are students who have federal Unit staff as a major advisor(s); whereas, Affiliated students are students who have financial or other close ties to a Unit, but do not have federal Unit staff as a major advisor(s).

Table 4. Number of graduate students and postdoctoral appointees participating in the Cooperatve Research Unit Program in fiscal year 1999 by minority status, gender and degree concentration.

Minority Status / Gender	Unit Students				Affiliated Students			
	Aquatic	Terrestrial	Integrated	Total	Aquatic	Terrestrial	Integrated	Total
Masters								
Non-minority male	128	79	7	214	36	59	15	110
Non-minority female	58	68	12	138	17	39	8	64
Minority male	10	7	1	18	1	1	1	3
Minority female	6	7	3	16	0	4	2	6
Subtotal	*202*	*161*	*23*	*386*	*54*	*103*	*26*	*183*
Doctoral								
Non-minority male	48	41	3	92	9	18	8	35
Non-minority female	18	22	6	46	8	15	3	26
Minority male	8	4	5	17	3	1	1	5
Minority female	3	5	0	8	1	0	1	2
Subtotal	*77*	*72*	*14*	*163*	*21*	*34*	*13*	*68*
Postdoctoral								
Non-minority male	7	11	7	25	1	1	1	3
Non-minority female	4	3	3	10	1	3	1	5
Minority male	2	0	1	3	0	0	0	0
Minority female	0	0	0	0	0	0	0	0
Subtotal	*13*	*14*	*11*	*38*	*2*	*4*	*2*	*8*
Total	*292*	*247*	*48*	*587*	*77*	*141*	*41*	*259*

Table 5. Number of degrees granted to graduate students participating in the Cooperative Research Unit Program in fiscal year 1999 by minority status, gender and degree.

Minority Status / Gender	Unit Students			Affiliated Students		
	Masters	Doctoral	Total	Masters	Doctoral	Total
Non-minority male	67	17	84	32	6	38
Non-minority female	33	6	39	10	0	10
Minority male	5	1	6	0	0	0
Minority female	2	1	3	1	0	1
Total	***107***	***25***	***132***	***43***	***6***	***49***

Table 6. Number of students supported by cooperative education agreements and source of support in fiscal year 1999.

Minority Status / Gender	BRD support			Other support		
	Masters	Doctoral	Total	Masters	Doctoral	Total
Non-minority male	2	1	3	7	3	10
Non-minority female	3	2	5	18	5	23
Minority male	1	1	2	4	3	7
Minority female	0	0	0	4	1	5
Totals	***6***	***4***	***10***	***33***	***12***	***45***

Table 7. Number of theses and dissertations prepared by Unit students and Affiliated students in fiscal year 1999.[1]

Unit students	Affiliated students	Total
131	49	180

[1] Based on the number of titles reported, not on the number of students reported as graduating. Some thesis and dissertation titles were not reported.

Table 8. Number of Cooperative Research Unit graduate students hired by individual agencies or organizations after completing their degrees in fiscal year 1999.

Agency or organization	Masters	Doctoral	Total
Biological Resources Division	4	4	8
U.S. Fish and Wildlife Service	10	0	10
Bureau of Land Management	2	0	2
National Park Service	2	0	2
U.S. Forest Service	4	0	4
National Science Foundation	0	0	0
Other Federal agency	6	1	7
State agency	32	3	35
Foreign government	0	1	1
Private Industry	15	4	19
University	13	10	23
Education continued	17	0	17
Peace Corps	0	0	0
Miscellaneous	1	2	3
Unemployed	0	0	0
Unknown	1	0	1
Total	*107*	*25*	*132*

Federal Unit Staff

Table 9. Services and activities provided by federal Unit staff during fiscal year 1999.

Services and activities provided	Number
Professional societies, boards, committees or similar groups	
Officer or other major position on committees, panels, boards, or similar groups	95
Session chairs	61
Memberships on committees, panels, boards or similar groups	163
Papers reviewed	801
Major proposals reviewed	564
Exchanges or short courses attended	21
Other[1]	16
Workshop and extension activities	
Symposia Conducted	19
Workshops conducted	40
Training sessions or short courses conducted	35
Public Lectures	122
Memberships on task forces	52
Memberships on recovery teams	14
Memberships on public panels or commisions	9
Television programs	11
Radio programs	32
Films	2
Extension publications	10
Newspaper releases	79
Other[2]	255

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[1] Includes newsletter articles; associate editor for a journal; editors for 2 journals; 1 editorial panel participation; 1 evaluation panel participation; Best Paper judge, Annual Meeting of the American Fisheries Society; participation in 2 regional research groups; 1 book review; review of 3 tenure packages; and membership in re-accreditation review team, Southeast Section of The Wildlife Society.

[2] Includes judging papers and presentations; reviewing environmental documents; giving invited seminars; producing videos; writing magazine or newsletter articles; distributing reprints; organizing seminars and technical sessions.

Table 10. University teaching assignments and classroom lectures by Federal Unit staff in fiscal year 1999.

	Semester system	Quarter system
Number of classes taught	79	22
Number of credit hours taught	202	43
Number of guest lectures in university classes	157	25

HONORS & AWARDS

Abbitt, R.; Idaho Student; Board of Directors Student Paper Award, 1999 Cooper Ornithological Society Annual Meeting.

Allen, B.; Colorado Student; Best Aquatic Ecology Presentation Award at 1998 Colorado State University Annual Water Symposium.

Alvarez-Flores, C.M.; Washington Student; Fulbright Scholarship, 1998, for academic excellence.

Anderson, S.; Wyoming Leader; Professional of the Year, The Wildlife Society.

Argent, D.G.; Pennsylvania Student; Roger Latham Award, for exceptional contributions in outreach and public education.

Badyaev, A.; Montana Wildlife Student; College of Arts and Sciences Postdoctoral Fellow for outstanding research and productivity.

Bakker, K.K.; South Dakota Student; Outstanding Wildlife Ph.D. Student Award, South Dakota Chapter, The Wildlife Society, March 1999.

Barichivich, W.J.; Florida Student; Outstanding M.S. Research Award, Wildlife Graduate Student Association.

Baxter, C.; Oregon Student; (1) Xerox Scholarship; (2) Thomas G. Scott Achievement Fund Graduate Scholarship; (3) Kalamazoo Foundation (Trout Unlimited) Scholarship; (4) Western Division American Fisheries Society Scholarship; (5) Yrex (Oregon State University) Scholarship.

Beauchamp D.A.; Utah Assistant Fisheries Leader; (coauthored by W.C. Pitt, and M.R. Conover) Finalist for Best Paper of the Year, *North American Journal of Fisheries Management*, 1998.

Bergstedt, L.C.; Montana Fisheries Student; Elected President, Student Subsection of the Education Section, American Fisheries Society.

Bounds, D.; Maryland Assistant Wildlife Leader; STAR Award, U.S. Geological Survey's Executive Leadership Team, 1999.

Burnham, K.P.; Colorado Assistant Wildlife Leader; recipient of the "Twentieth Century Distinguished Service Award for Outstanding Contribution to Environmental Statistics."

Cano, F.; Arizona Student; nominated to the "Who's Who Among Students in American Colleges and Universities" 1999.

Carter, S.; Washington Student; (1) School of Fisheries Egtvedt Endowment Fellowship, University of Washington, 1998, for academic excellence; (2) School of Fisheries Faculty Merit Award, University of Washington for academic excellence, 1998.

Castleberry, S.; West Virginia Student; Outstanding Graduate Student Award, West Virginia University Chapter of Xi Sigma Pi.

Chalfoun, A.; Missouri Student; (1) Travel Scholarship from NASA to attend the Conservation Biology meetings in College Park, Maryland; (2) James D. Chambers Memorial Scholarship Award; (3) elected as Full Member of Sigma Xi, the National Scientific Research Society.

Chamberlain, E.; Missouri Student; (1) National Science Foundation Fellowship; (2) Superior Graduate Student Achievement Award from Graduate Student Association for 1998–1999.

Corley, B.; Oklahoma Student; Best Conference Paper Award (with co-authors W.L. Fisher and D.M. Leslie, Jr.), Nongame Session, Southeastern Section of The Wildlife Society, Oklahoma City, Oklahoma.

Covington, S.; Wyoming Student; George T. Baxter Fellowship.

Crandell, C.; Washington Student; (1) School of Forest Resources Anderson Scholarship, University of Washington, 1998, for academic excellence; (2) School of Forest Resources Klemme Scholarships, University of Washington, 1998.

Dare, M.; Wyoming Student; Vern Bressler Memorial Scholarship.

Dilts, E.W.; Georgia Student; Best Student Paper Award (with co-author C.A. Jennings), 1999 Annual Meeting, Georgia Chapter, American Fisheries Society, Tifton, Georgia..

Drobney, R.; Missouri Assistant Wildlife Leader; (1) elected as a member of the Graduate Faculty Senate, representing the Biological Sciences Sector; (2) MoRAP Steering Committee Member of the Year Award for his special contributions to the partnership (MoRAP was 1 of 24 programs selected from 300 to receive a Certificate of Environmental Achievement from *Renew America*).

Duffy, W.G.; California Leader; U.S. Geological Survey STAR Award for work on the Salton Sea.

Field, R.; Massachusetts Assistant Wildlife Leader; Certificate for Outstanding Contributions, The Wildlife Society's 2nd International Wildlife Management Congress, Gödöllő, Hungary.

Finley, C.; New Mexico Student; Best Student Poster Award (with co-authors P. Arrowood and P.J. Zwank), 32nd Joint Meeting of Arizona and New Mexico Chapters of The Wildlife Society and American Fisheries Society, Gallop, New Mexico.

Fischer, T.D.; South Dakota Student; (1) Gay Simpson Memorial Award, from the Central Flyway Technical Committee; (2) Outstanding Masters Graduate Student Award, Department of Wildlife and Fisheries Sciences, South Dakota State University.

Gatewood, D.E.; Arizona Affiliated Student; (1) 1999 Truman D. Picard Scholarship in the College Category, Intertribal Timber Council; (2) G.E.P. Smith Scholarship, University of Arizona.

Glasgow, K.; Affiliated Washington Student; School of Fisheries Egtvedt Endowment Fellowship, University of Washington, 1998, for academic excellence.

Goldstein, J.; Wyoming Student; Louis C. "Red" Rockett Memorial Scholarship.

Habron, G.; Oregon Student; Savory Award for the Outstanding Graduate Student in the College of Agricultural and Natural Resource Sciences, Oregon State University, 1999.

Hess, B.J.; Georgia Student; Third Place, Best Student Paper Competition (with co-author C.A. Jennings), D.B. Warnell School of Forest Resources Graduate Student Symposium.

Hibbert, L.; Missouri Student; (1) Thurgood Marshall Graduate Fellow for 1999–2000 academic year, University of Missouri; (2) George Washington Carver Fellowship.

Holt, E.; Texas Student; Cottam Award (second place) for Best Student Paper and Presentation, Texas Chapter of The Wildlife Society Annual Meeting, Amarillo, Texas.

Horn D.; Iowa Student; Scholarship, Iowa State University's Center for Teaching Excellence.

Howarter, S.R.; Florida Student; William and Elyse Jennings Scholarship.

Hubert, W.; Wyoming Assistant Fisheries Leader; Award of Excellence in Fisheries Education, American Fisheries Society.

Isaak, D.; Wyoming Student; Dr. George E. Menkens Memorial Scholarship.

Isermann, D.; Tennessee Student; Robert M. Jenkins Memorial Reservoir Research Scholarship, awarded by the Reservoir Committee of the Southern Division, American Fisheries Society.

Jester, L.; Wisconsin Fisheries Student; (1) Outstanding Graduate Student Award, University of Wisconsin–Stevens Point; (2) Outstanding Research Assistant Award, University of Wisconsin–Stevens Point.

Jorgensen, K.; Wisconsin Fisheries Student; Worth Fellowship, for academic achievement.

Kazmaier, R.; Oklahoma Affiliated Student; Byron Moser Award for Best Paper Presentation in the Fish and Wildlife Conservation Section, Oklahoma Academy of Science, Chickasha.

Kitcheyan, D.C.; Arizona Student; (1) Academic Scholarship from the University of Arizona; (2) nominated to the "Who's Who Among Students in American Colleges and Universities" 1999.

Klein, D.R.; Alaska Cooperator and former Senior Scientist; The Wildlife Society's 1999 Aldo Leopold Memorial Award, in recognition of "distinguished service to wildlife conservation."

Koenen, K.; Arizona Student; awarded the Best Student Poster Award (with co-authors S. DeStefano and P. Krausman) at the 1998 National Wildlife Society Meeting in Buffalo, New York.

Kuhne, W.; New Mexico Student; Dean's Award of Excellence, New Mexico State University College of Agriculture and Home Economics, Las Cruces.

Levesque, L.; Oklahoma Affiliated Student; Oklahoma State University Student Chapter of The Wildlife Society's Outstanding Graduate Student Award.

Livengood, K.; Missouri Student; Conservation Biology Summer Research Fellowship for 1999.

Loftin, C.S.; Maine Assistant Wildlife Leader; National Wetlands Conservation Award by the U.S. Fish and Wildlife Service.

Long, J.; Oklahoma Student; Southern Division of the American Fisheries Society's Robert M. Jenkins Memorial Reservoir Research Award, Chattanooga, Tennessee.

Lucia, M.; Idaho Student; Ted Trueblood Communications Award for the Best Student Paper at the Idaho Chapter of The Wildlife Society, March 1999.

Lyman, A.; Colorado Student; (1) Cultural Diversity Scholarship from Colorado Division of Wildlife; (2) Environmental/Outdoor Leadership Scholarship from *Backpacker Magazine*.

Martin, P.; Montana Wildlife Student; (1) National Science and Engineering Research Council Fellowship; (2) Bertha Morton Scholarship Award; (3) Natural Sciences and Engineering Research Council of Canada, postgraduate scholarship, April 1999.

Martin, T.E.; Montana Assistant Wildlife Leader; Invited Keynote Address, First Joint Meeting of Ecological Societies of New Zealand and Australia at Dunedin, New Zealand.

Mitro, M.G.; Montana Fisheries Student; Gary Lynch Memorial Scholarship, Department of Biology, Montana State University.

Morales, S.; Arizona Affiliated Student; Centennial Achievement Award, University of Arizona.

Morea, C.R.; Florida Student; African Safari Club of Florida Scholarship.

Neves, R.; Virginia Leader; Distinguished Service Award from the American Fisheries Society.

Nielsen, B.; Idaho Student; Board of Directors Student Paper Award, 1999 Cooper Ornithological Society Annual Meeting.

Olson, C.; Montana Wildlife Student; Les Pengelly Memorial Scholarship for the 1998–1999 academic year.

Pagen, R.; Missouri Student; (1) Graduate Professional Council Travel Scholarship; (2) Charles P. Bell Conservation Scholarship.

Parrish, D.L.; Vermont Leader; U.S. Geological Survey, Biological Resources Division, STAR Award for publication of Atlantic salmon workshop volume in *Canadian Journal of Fisheries and Aquatic Sciences*.

Parson, W.; Montana Wildlife Student; Division of Biological Sciences Pre-doctoral Fellowship, University of Montana.

Pfau, R.; Oklahoma Affiliated Student; Outstanding Ph.D. Award from the Department of Zoology, Oklahoma State University, Stillwater.

Pidgeon, A.; Affiliated Wisconsin Wildlife Student; Greentree Garden Club's Aldo Leopold Scholarship Graduate Student Award, Department of Wildlife Ecology, 1999.

Quist, M.C.; Kansas Student; (1) Best Student Paper, Annual Meeting of the Kansas Chapter of the American Fisheries Society; (2) Student Travel Award to give paper at the 1999 Annual Meeting, American Fisheries Society.

Raborn, S.; Mississippi Student; Best Student Paper (with co-authors L.E. Miranda and M.T. Driscoll) Award, 1999 Annual Meeting of the Mississippi Chapter, American Fisheries Society.

Reynolds, J.B.; Alaska Cooperator and former Unit Leader; Frank and Marjorie Meek Endowed Chair, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks.

Rodriguez, M.; Arizona Affiliated Student; G.E.P. Smith Scholarship, University of Arizona.

Rusch, D.H.; Wisconsin Wildlife Leader; Touchstone Award, The Wildlife Management Institute, San Francisco, California, for producing "The Wisconsin Student Hunter Project," a video aired on Wisconsin Public Television.

Ryce, E.K.N.; Montana Fisheries Student; Elected President-Elect, Student Subsection of the Education Section, American Fisheries Society.

Schreck, C.B.; Oregon Fisheries Leader; (1) co-author of 1 of 5 top papers for 1998 in *North American Journal of Fisheries Management*, American Fisheries Society; (2) co-author of 1 of 5 top papers for 1998 in *Progressive Fish Culturist*, American Fisheries Society.

Scott, J.M.; Idaho Leader; Elected Fellow, American Association for the Advancement of Science; Twentieth Century Distinguished Service Award, Ninth Lukacs Symposium.

Seals, C.; Oregon Student; Best Student Paper, Western Division, American Fisheries Society, Moscow, Idaho.

Short, P.; Wisconsin Fisheries Student; Walleyes for Tomorrow Scholarship, for academic achievement.

Stepenuck, K.; Wisconsin Fisheries Student; (1) Best Student Paper, 60th Midwest Fish and Wildlife Conference, Cincinnati, Ohio; (2) Walleyes for Tomorrow Scholarship, for academic achievement.

Stephens, T.; Wisconsin Fisheries Student; (1) Trout Unlimited Bill Beck Memorial Scholarship; (2) Twelve Apostles Musky Club Scholarship.

Stolen, E.D.; Florida Student; William and Elyse Jennings Scholarship.

Stone, K.; Alaska Affiliated Student; University of Alaska, Fairbanks Thesis and Completion Fellowships and Graduate School Tuition Scholarships for academic year 1999–2000.

Tamayo, M.; Washington Student; School of Fisheries Richard Van Cleve Memorial Scholarship, University of Washington, 1998, for academic excellence.

Tewksbury, J.; Montana Wildlife Student; (1) Graduate Fellowship for outstanding graduate career performance; (2) 2 National Science Foundation Dissertation Improvement Grants.

Thompson, B.; New Mexico Leader; (1) Outstanding Alumnus for 1999, College of Natural Resources at the University of Wisconsin-Stevens Point.

Thompson, F.R., III; Missouri Cooperator; (1) "Elected Fellow" of the American Ornithologists' Union; (2) Associate Editor, *Wildlife Society Bulletin*, in spring 1999.

Thompson, J.; Maryland Student; Best Oral Presentation, Maryland Environmental and Estuarine Studies Program, Annual Meeting.

Tims, J.L.; New York Student; Best Paper at the 1999 GSA Symposium, Department of Natural Resources, Cornell University, Ithaca, New York.

Torgersen, C.; Oregon Student; (1) William A. Fischer Memorial Scholarship, 1999, American Society for Photogrammetry and Remote Sensing; (2) Thomas G. Scott Achievement Fund Graduate Scholarship, 1999; (3) Department of Fisheries and Wildlife, Oregon State University, Graduate Student Scholarship, 1999; (4) Oregon Chapter, American Fisheries Society Scholarship.

Turner, L.; Affiliated Washington Student; (1) College of Architecture and Urban Planning Special Service Award, University of Washington, 1999; (2) College of Architecture and Urban Planning Outstanding Project Award, University of Washington, 1999; (3) College of Architecture and Urban Planning Teaching Assistantship, University of Washington, 1999.

Weakland, C.; West Virginia Student; Outstanding Graduate Student in the Division of Forestry at West Virginia University, Morgantown.

Wedemeyer, K.; former Alaska Student; Pacific Air Force Natural Resources Manager of the Year Award for 1998.

Whitledge, G.; Missouri Student; 1999 Conservation Biology Summer Research Fellowship.

Young, B.; South Dakota Student; Society of Sigma Xi Award for best Ph.D. Proposal Presentation.

PUBLICATIONS

Scientific Publications of Federal Unit Staff[1]

Agostinho, A.A., L.E. Miranda, L.M. Bini, L.C. Gomes, S.M. Thomaz, and H.I. Susuki. 1999. Patterns of colonization in neotropical reservoirs, and prognoses on aging. Pages 227–265 *in* J. G. Tundisi and M. Straškraba, editors. Theoretical reservoir ecology and its applications. Backhuys Publishers, Leiden, The Netherlands. (reservoir fisheries, Brazil, reservoir aging)

Ainley, D.G., S.S. Jacobs, C.A. Ribic, and I. Gaffney. 1998. Seabird distribution and oceanic features of the Amundsen and southern Bellingshausen Seas. Antarctic Science 10(2):111–123. (seabirds, oceanic features, Antarctic)

Alisauskas, R.T. E.E. Klaas, K.A. Hobson, and D.C. Ankney. 1998. Stable-carbon isotopes support use of adventitious color to discern winter origins of lesser snow geese. Journal Field Ornithology: 69(2):262–268. (lesser snow geese, wintering, winter habitats)

Alisauskas, R.T., S.M. Slattery, J.P. Ryder, M.L. Gloutney, A.D. Afton, R.H. Kerbes, and M.R. McLandress. 1998. Discrimination of Ross's and lesser snow goose eggs. Journal of Field Ornithology 69(4):647–653. (Ross's, lesser, snow goose, eggs)

Allen, C.R., E.A. Forys, and C.S. Holling. 1999. Body mass patterns predict invasions and extinctions in transforming landscapes. Ecosystems 2:114–121. (cross-scale, ecosystem structure, extinctions)

Alrubaian, J., P. Danielson, M. Fitzpatrick, C. Schreck, and R.M. Dores. 1999. Cloning of a second proopiomelanocortin cDNA from the pituitary of the sturgeon, *Acipenser transmontanus*. Peptides 20(4):431–436. (sturgeon, peptide, molecular biology)

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[1] Entries marked with an asterisk have not been checked for accuracy.

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Zale, A.V., technical editor. 1998. The relationship between land management activities and habitat requirements of bull trout. Report for Montana Bull Trout Restoration Team, Montana Department of Fish, Wildlife and Parks, Helena, Montana. 78 pages. (bull trout, habitat requirements, land management)

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Theses and Dissertations of Unit Graduate Students

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Armstrong, J.L. 1999. Movement, habitat selection and growth of early-juvenile Atlantic sturgeon in Albemarle Sound, North Carolina. M.S. Thesis. North Carolina State University, Raleigh. 78 pages.* (anadromous, sturgeon, movement, growth)

Artmann, M. 1999. Influence of upland cover on occupancy rates of nest structures by mallards. M.S. Thesis. University of Montana, Missoula. 37 pages.* (habitat quality, hiding cover, mallards)

Azevedo, C.M. 1998. Nitrogen transfer using ^{15}N as a tracer in an integrated aquaculture and agriculture system. Ph.D. Dissertation. The University of Arizona, Tucson. 105 pages. (nitrogen transfer, aquaculture, agriculture)

Badyaev, A.V. 1998. Evolution of sexual dimorphism in birds: ecological patterns, current selection, and ontogenetic variation. Ph.D. Dissertation. University of Montana, Missoula. 118 pages.* (sexual dimorphism, variation, ecological patterns)

Bailey, J.R. 1999. A working model to assist in determining initiation of supplemental feeding of elk and a carrying capacity model for the National Elk Refuge, Jackson, Wyoming. M.S. Thesis. University of Wyoming, Laramie. 83 pages.* (elk, model, carrying capacity, supplemental feeding)

Baldwin, C.M. 1998. Strawberry Reservoir food web interactions: a bioenergetic assessment of salmonid diet and predator-prey supply and demand. M.S. Thesis. Utah State University, Logan. 82 pages.* (salmonid food web, bioenergetics, predator-prey relationships)

Beaty, B.B. 1999. Development of juvenile culture techniques and testing of potential biomarkers of environmental stress in freshwater mussels. Ph.D. Dissertation. Virginia Tech, Blacksburg. 166 pages.* (mussels, propagation, biomarkers)

Bjorgo, K.A. 1999. Seasonal movement and habitat use of striped bass in the Combahee River, South Carolina. M.S. Thesis. Clemson University, Clemson, South Carolina. 22 pages.* (striped bass, movement, radio telemetry, habitat)

Borsuk, F.A., Jr. 1998. Effects of polychlorinated biphenyls on the gametes and early life stages of brown trout. Ph.D. Dissertation. The Pennsylvania State University, University Park. 124 pages.* (PCB, brown trout, reproduction)

Bump, C.A. 1999. Survival and ecological impacts of released ring-necked pheasants on Cape Cod National Seashore. M.S. Thesis. University of Massachusetts, Amherst. 70 pages. (pheasant, survival, hunting, release)

Campbell, C. 1998. Linking landscape patterns to microhabitat parameters for Atlantic salmon. M.S. Thesis. University of Massachusetts, Amherst. 120 pages. (GIS, Atlantic salmon, large scale patterns)

Canavan, C.M. 1998. Seasonal variability in total mercury and methylmercury at Elephant Butte and Caballo reservoirs, Sierra County, New Mexico. M.S. Thesis. New Mexico State University, Las Cruces. 122 pages.* (mercury, sediments, New Mexico)

Carlo-Joglar, T.A. 1999. Diet, fruit preference and seed dispersal capabilities of fruit-eating birds in north-central Puerto Rico. M.S. Thesis. North Carolina State University, Raleigh. 107 pages.* (Puerto Rico, birds, feeding ecology)

Carter, S.K. 1999. Ecosystem effects of sea otter predation and commercial sea urchin harvest on nearshore benthic communities in northern Washington. M.S. Thesis. University of Washington, Seattle. 286 pages.* (marine ecology, marine invertebrates, trophic food web)

Cartwright, M.A. 1998. Quantifying cutthroat trout predation on sockeye salmon fry using a bioenergetics approach. M.S. Thesis. Utah State University, Logan. 73 pages.* (trout predation, bioenergetics)

Chapman, E.W. 1999. Small mammal use of three riparian management schemes in southwestern Wisconsin. M.S. Thesis. University of Wisconsin, Madison. 85 pages.* (riparian, management, small mammals)

Chappell, W.S. 1998. Habitat associations of fish assemblages on the Tishomingo National Wildlife Refuge. M.S. Thesis. Oklahoma State University, Stillwater. 78 pages. (fish assemblages, freshwater fish habitat)

Churchill, J.B. 1998. Winter movements and habitat use of northern saw-whet owls at Assateague Island, Maryland. M.S. Thesis. West Virginia University, Morgantown. 84 pages.* (saw-whet owls, habitat, roosts)

Coey, R.M. 1998. Effects of sedimentation on incubating coho salmon, (*Oncorhynchus kisutch*) in Prairie Creek, California. M.S. Thesis. Humboldt State University, Arcata, California. 134 pages. (stream sedimentation, salmon reproduction)

Corbino, J.M. 1997. Pigments as complementary measures of community composition and indicators of limiting factors for phytoplankton in the Atchafalaya River Basin. M.S. Thesis. Louisiana State University, Baton Rouge. 35 pages. (phytoplankton, Atchafalaya River)

Covington, J.S. 1999. Watershed-scale assessment of instream flows for trout in low-gradient, alluvial valley streams. M.S. Thesis. University of Wyoming, Laramie. 105 pages.* (trout, streams, watershed)

D'Almeida, G.B. 1998. The seasonal timing and reproductive behavior of the cape hake, *Merluccius capensis*, in the Northern Benguela ecosystem: adaptation to upwelling. M.S. Thesis. University of Maryland Eastern Shore, Princess Anne.* (Cape hake, behavior, reproduction)

D'Elia, J. 1998. Using geographic information systems to examine fire ignition patterns and fire danger in the arid and semi-arid Western United States. M.S. Thesis. University of Idaho, Moscow. 242 pages. (GIS, fire history, management)

Daniels, L.R. 1999. Diet of American eels (*Anguilla rostrata* LeSueur) in five freshwater lakes, Maine, U.S.A. M.S. Thesis. University of Maine, Orono. 60 pages. (American eel, feeding, freshwater lakes)

Darby, P.C. 1998. Florida apple snail (*Pomacea paludosa* SAY) life history in the context of a hydrologically fluctuating environment. Ph.D. Dissertation. University of Florida, Gainesville. 154 pages. (mollusc ecology, Everglades, apple snail)

Davis, M.L. 1999. Factors affecting the reproductive success of American oystercatchers on Cape Lookout National Seashore. M.S. Thesis. North Carolina State University, Raleigh. 86 pages.* (shorebirds, reproduction, nesting success)

DeBolt, B.L. 1999. Food habits and habitat use by sympatric mule deer and elk in south-central Wyoming. M.S. Thesis. University of Wyoming, Laramie. 82 pages.* (mule deer, elk, habitat, competition)

Denmon, P. 1998. Early successional habitat use by nongame wildlife species in American woodcock breeding habitat in West Virginia. M.S. Thesis. West Virginia University, Morgantown. 120 pages.* (nongame wildlife, early successional habitat)

Devlin, G.J., III. 1998. Population dynamics of salmonids stocked into the Caney Fork River below Center Hill Dam, Tennessee. M.S. Thesis. Tennessee Technological University, Cookeville. 100 pages. (creel survey, trout, water quality)

Dilts, E.W. 1999. Effects of fine sediment and gravel quality on survival to emergence of larval robust redhorse, *Moxostoma robustum*. M.S. Thesis. University of Georgia, Athens. 61 pages.* (reproductive biology, habitat quality, substrates)

Duerr, A.E. 1999. Abundance of lost and discarded fishing tackle and implications for waterbird populations in the United States. M.S. Thesis. The University of Arizona, Tucson. 88 pages. (lost tackle, impacts on waterbirds, pollution)

Estey, M.E. 1998. Characteristics and distribution of protected wetland basins in eastern South Dakota. M.S. Thesis. South Dakota State University, Brookings. 53 pages. (wetlands, description, GIS, distribution)

Fedrizzi, J. 1998. Craig Mountain cooperative management area—fire management plan. M.S. Thesis. University of Idaho, Moscow. 214 pages. (fire, management, Idaho, Douglas-fir)

Fischer, T.D. 1998. Anura of eastern South Dakota: their distribution and characteristics of their wetland habitats, 1997–1998. M.S. Thesis. South Dakota State University, Brookings. 93 pages. (amphibians, reptiles, roadside surveys, wetlands)

Fitzgerald, T.J. 1999. Integration of two methods for rapid functional assessment of wetlands at different scales. M.S. Thesis. University of Massachusetts, Amherst. 142 pages. (wetlands, methods, Connecticut River)

Fitzsimmons, K.M. 1999. Use of saline wastewater for revegetation and creation of wildlife habitat. Ph.D. Dissertation. The University of Arizona, Tucson. 138 pages. (revegetation, saline wastewater, wildlife habitat)

Forsberg, W.V. 1999. Growth, distribution, and relative abundance of young-of-the-year bluegill and black crappie in Ruth Reservoir, California. M.S. Thesis. Humboldt State University, Arcata, California. 43 pages. (population characteristics, fresh-water fish)

Fregien, S.K. 1998. Characterization of moist-soil plant and macroinvertebrate communities within seasonal wetlands created by flooding agricultural fields on the Tule Lake National Wildlife Refuge, California. M.S. Thesis. University of Washington, Seattle. 159 pages.* (seasonal wetlands, restoration, macroinvertebrates, moist-soil plants)

Frescino, T. 1999. Modelling spatially explicit forest structural attributes using generalized additive mixed models. M.S. Thesis. Utah State University, Logan. 67 pages.* (forest structure modeling, forest attributes)

Gabrey, S.W. 1999. Effects of winter burning and structural marsh management on bird and plant communities of the Gulf Coast Chenier Plain. Ph.D. Dissertation. Louisiana State University, Baton Rouge. 148 pages. (marsh management, burning)

Gannon, M.P. 1998. Growth and distribution of larval fishes in the Atchafalaya River Basin, Louisiana. M.S. Thesis. Louisiana State University, Baton Rouge. 114 pages. (larval fishes, Atchafalaya River)

Gemperle, C.A. 1998. Early life history and egg-to-fry survival of kokanee in Lake Tahoe. M.S. Thesis. Utah State University, Logan. 95 pages.* (salmonids, life history, Lake Tahoe)

Gerber, L.R. 1998. Risk analysis and use of stochastic population models for determining Endangered Species Act status of North Pacific marine mammals. Ph.D. Dissertation. University of Washington, Seattle. 140 pages.* (computer modeling, ESA, marine mammals)

Goforth, R.R. 1999. Local and landscape-scale relations between stream communities, stream habitat, and terrestrial land cover properties. Ph.D. Dissertation. Cornell University, Ithaca, New York. 303 pages.* (stream habitat, land cover, landscale scale)

Goodwin, K.R. 1999. American eel subpopulation characteristics in the Potomac River drainage, Virginia. M.S. Thesis. Virginia Tech, Blacksburg. 107 pages.* (eel, subpopulation)

Gore, L.B. 1999. Habitat preference and management strategies for grassland birds on the Wallkill River National Wildlife Refuge, New Jersey. M.S. Thesis. University of Massachusetts, Amherst. 57 pages. (grassland birds, habitat use, management)

Grant, G.C. 1999. Growth, spawning behavior and feeding strategies of trout in a small midwestern stream. Ph.D. Dissertation. University of Minnesota, St. Paul. 121 pages.* (C^{14} glycerine competition, species replacement, drift feeding, energetics, microhabitat selection)

Guensch, G.R. 1999. Validation of an individual-based, mechanistic habitat selection model for drift-feeding salmonids. M.S. Thesis. Utah State University, Logan. 85 pages.* (habitat selection model, salmonid feeding habits)

Habron, G. 1999. Assessment of critical sociocultural and ecological variables for adaptive watershed management. Ph.D. Dissertation. Oregon State University, Corvallis. 175 pages.* (human dimensions, adaptive management, watershed analyses)

Haley, N.J. 1999. Habitat characteristics and resource use patterns of sympatric sturgeons in the Hudson River estuary. M.S. Thesis. University of Massachusetts, Amherst (student of New York Unit). 124 pages.* (habitat, sturgeon, Hudson River)

Hebdon, J.L. 1999. Prey availability, diet and body condition of sub-adult trout from fall through winter in regulated rivers, Wyoming. M.S. Thesis. University of Wyoming, Laramie. 73 pages.* (trout, diet, winter)

Herner-Thogmartin, J.H. 1999. Ecology of an introduced Rocky Mountain elk *(Cervus elaphus nelsoni)* herd in Arkansas. M.S. Thesis. University of Arkansas, Fayetteville. 136 pages.* (introduced species, ungulate, elk ecology)

Hess, B.J. 1999. Summer food habits of adult striped bass *Morone saxatilis* in the trout waters of the upper Chattahoochee River, Georgia. M.S. Thesis. University of Georgia, Athens. 38 pages.* (food habits, seasonal feeding ecology, striped bass)

Hess, N.A. 1999. Seabirds in the northern Gulf of Mexico: distribution, abundance and associations with oceanographic features. M.S. Thesis. University of Wisconsin, Madison. 166 pages.* (seabirds, distribution, abundance)

Hillmeier, D.C. 1999. Summer habitat utilization by adult spring chinook salmon (*Oncorhynchus tshawytscha*), South Fork Trinity River, California. M.S. Thesis. Humboldt State University, Arcata, California. 93 pages. (salmonid habitat use, seasonal use)

Hoel, S.M. 1998. Evaluation of the relations of fish and invertebrate communities to habitat conditions affected by low and variable flows in two Missouri prairie streams. M.S. Thesis. University of Missouri–Columbia. 227 pages. (Missouri, prairie streams, low flow, fish, invertebrate communities)

Holloran, M.J. 1999. Sage grouse (*Centrocercus urophasianus*) seasonal habitat use near Casper, Wyoming. M.S. Thesis. University of Wyoming, Laramie. 130 pages.* (sage grouse, habitat, upland game bird)

Holt, E.A. 1999. The distribution and diversity of Texas vertebrates: an ecoregion perspective. M.S. Thesis. Texas Tech University, Lubbock. 117 pages. (GIS, GAP analysis, mammals, birds, herpetofauna)

Jester, L.L. 1998. The geographic distribution of the aquatic milfoil weevil *(Euhrychiopsis lecontei)* and factors influencing its density in Wisconsin Lakes. M.S. Thesis. University of Wisconsin–Stevens Point. 78 pages.* (weevil, Eurasian watermilfoil, biocontrol)

Jones, W.J. 1999. An evaluation of the use of a fishway by anadromous river herrings and the predatory impact on young-of-the year by resident fish communities in a southern Delaware impoundment. M.S. Thesis. University of Maryland Eastern Shore, Princess Anne.* (fish, ladder, spawning)

Karhu, R.R. 1999. Field trials of technical pyriproxyfen (Nylar) and pyraperm in black-tailed prairie dog (*Cynomys ludovicianus*) towns on the Rocky Mountain Arsenal National Wildlife Refuge, Colorado. M.S. Thesis. University of Wyoming, Laramie. 163 pages.* (black-tailed prairie dog, fleas, Rocky Mountain Arsenal)

Katzman, L.M. 1998. Effects of predation on status of Arctic grayling at Red Rock Lakes National Wildlife Refuge, Montana. M.S. Thesis. Montana State University, Bozeman. 207 pages.* (Arctic grayling, predation, Red Rock Lakes)

Kirkpatrick, C.K. 1999. Trends in grassland bird abundance following prescribed burning in southern Arizona. M.S. Thesis. The University of Arizona, Tucson. 69 pages. (bird abundance, prescribed burning, grassland avifauna)

Kitcheyan, D.C. 1999. Population structure of Apache trout (*Oncorhychus apache*) in Flash and Squaw creeks on the Fort Apache Indian Reservation, Arizona. M.S. Thesis. The University of Arizona, Tucson. 143 pages. (Apache trout, reintroductions, populations)

Klute, D.S. 1999. Modeling habitat relationships for American woodcock in Pennsylvania: effects of spatial autocorrelation and spatial scale. Ph.D. Dissertation. The Pennsylvania State University, University Park. 168 pages.* (woodcock habitat, modeling)

Kocovsky, P.M. 1999. Dynamics and feeding ecology of the unexploited walleye population of Pymatuning Sanctuary, Pennsylvania, 1997–1998. M.S. Thesis. The Pennsylvania State University, University Park. 53 pages.* (walleye, exploitation, population dynamics)

Lambert, T.M. 1998. Heterogeneity and bias in abundance estimates of outmigrating chinook salmon in the Chena River, Alaska. M.S. Thesis. University of Alaska Fairbanks. 114 pages.* (abundance estimates, bias, chinook salmon)

Lieb, D. 1998. The effects of urban runoff on the benthic macroinvertebrate community of Thompson Run, Centre County, Pennsylvania. M.S. Thesis. The Pennsylvania State University, University Park. 118 pages.* (runoff, macroinvertebrates)

Loftin, C.S. 1998. Assessing patterns and processes of landscape change in Okefenokee Swamp, Georgia. Ph.D. Dissertation. University of Florida, Gainesville. 835 pages. (swamp vegetation, landscape change, species composition, recovery)

Maio-Maples, K.J. 1998. Quantitative description of temporal and spatial patterns in spawning activity of the horseshoe crab, *Limulus polyphemus*. M.S. Thesis. University of Maryland Eastern Shore, Princess Anne.* (horseshoe crab, spawning, patterns)

Mangan, B.P. 1999. The influence of flow on habitat use by fish in a large river. Ph.D. Dissertation. The Pennsylvania State University, University Park. 74 pages.* (river habitat, fish)

Manolis, J.C. 1999. Clearcut edge effects on avian nesting success in extensively forested, northern hardwood-conifer landscapes. Ph.D. Dissertation. University of Minnesota, St. Paul. 92 pages.* (reproduction, forest-nesting birds, predation)

Mayer, M.S. 1999. Density and mortality of white-tailed deer in Myles Standish State Forest, Southeastern Massachusetts. M.S. Thesis. University of Massachusetts, Amherst. 66 pages. (white-tailed deer, population density, mortality)

Mayo, R.M. 1999. Growth of blue catfish, channel catfish and flathead catfish relative to latitude and physical characteristics of the lower Mississippi River. M.S. Thesis. Mississippi State University, Mississippi State. 77 pages. (Mississippi River, catfish, growth, large river ecology)

McCracken, K.G. 1999. Systematics, ecology, and social biology of the musk duck (*Biziura lobata*) of Australia. Ph.D. Dissertation. Louisiana State University, Baton Rouge. 169 pages. (musk duck, Australia, social biology)

McFarland, C.A. 1998. Potential agricultural insecticide exposure of Indiana bats (*Myotis sodalis*) in Missouri. M.S. Thesis. University of Missouri–Columbia. 256 pages. (Indiana bats, endangered species, contaminants)

McIntyre, J. 1998. Injury rates of juvenile chinook salmon exposed to electrical fields. M.S. Report. University of Alaska Fairbanks. 22 pages.* (electrofishing, injury, salmon)

Mesa, M.G. 1998. Ecological influence of bacterial kidney disease on juvenile spring chinook salmon: effects on predator avoidance ability, smoltification, and physiological response to stress. Ph.D. Dissertation. Oregon State University, Corvallis. 153 pages.* (bacterial kidney disease, salmon, smoltification, stress)

Mitro, M.G. 1999. Sampling and analysis techniques and their application for estimating recruitment of juvenile rainbow trout in the Henrys Fork of the Snake River, Idaho. Ph.D. Dissertation. Montana State University, Bozeman. 288 pages.* (rainbow trout, recruitment, sampling, analytical techniques)

Nash, M.K. 1999. Age and growth of flathead catfish and channel catfish in the Tallapoosa River, Alabama and the Ocmulgee River, Georgia. M.S. Thesis. Auburn University, Auburn, Alabama. 75 pages. (catfish, fish populations, freshwater fishery)

Nate, N. 1999. Predicting walleye (*Stizostedion vitreum*) presence, reproduction, and abundance in northern Wisconsin lakes. M.S. Thesis. University of Wisconsin–Stevens Point. 123 pages.* (walleye, exploitation, reproduction)

Nemeth, M.L. 1999. An assessment of the stocked and wild trout fishery in the South Fork of the Holston River below South Holston Dam, Tennessee. M.S. Thesis. Tennessee Technological University, Cookeville. 63 pages. (trout, tailwaters, spawning, stocking)

Nerbonne, B.A. 1999. Effects of land use and sediment on the distribution of benthic invertebrates and fish in the Whitewater River Watershed of Minnesota. M.S. Thesis. University of Minnesota, St. Paul. 69 pages.* (riparian areas, wood buffers, grass buffers, land use, macroinvertebrates, BMPs)

Newman, R.L. 1999. A biological assessment of four northern Black Hills streams and the reproductive success of longnose dace (*Rhinichthys cataractae*). M.S. Thesis. South Dakota State University, Brookings. 65 pages. (rapid bioassessment techniques, streams, species richness)

Nordmeyer, D.L. 1999. Effects of jet aircraft overflights and other potential disturbances on behavioral responses and productivity of nesting peregrine falcons. M.S. Thesis. Oregon State University, Corvallis. 97 pages.* (peregrine falcon, overflights, noise disturbance)

Olsen, R.E. 1999. Goose hunter opinions and vulnerability of lesser snow geese to electronic calling devices. M.S. Thesis. Louisiana State University, Baton Rouge. 63 pages. (lesser snow geese, electronic calling devices)

Olson, G.S. 1999. Population dynamics of Townsend's ground squirrels in southwestern Idaho. Ph.D. Dissertation. Colorado State University, Fort Collins. 254 pages.* (capture-recapture, spatially explicit modeling, survival rate estimation)

Orme, R.W. 1999. Natural reproductive potential of Bear Lake cutthroat trout in Strawberry Reservoir, Utah. M.S. Thesis. Utah State University, Logan. 94 pages.* (natural reproduction potential, cutthroat trout, productivity)

Owens, S.J. 1998. Growth characteristics of brown trout and rainbow trout in the South Fork of the Holston River, Tennessee. M.S. Thesis. Tennessee Technological University, Cookeville. 103 pages. (trout, habitat, growth)

Oyler-McCance, S.J. 1999. Genetic and habitat factors underlying conservation strategies for Gunnison sage grouse. Ph.D. Dissertation. Colorado State University, Fort Collins. 161 pages.* (habitat loss estimation, conservation genetics, habitat fragmentation, micro-satellite DNA)

Palmer, A. 1999. Parental care of peregrine falcons in interior Alaska and the effects of low-altitude jet overflights. M.S. Thesis. Oregon State University, Corvallis. 115 pages.* (peregrine falcons, nesting behavior, overflight disturbance)

Patterson, S. 1998. The effect of growth rate on the maturation schedule of kokanee, *Oncorhychus nerka*. M.S. Thesis. University of Idaho, Moscow. 102 pages. (kokanee, growth rate, age at maturity, initiation of maturation)

Paukert, C.P. 1998. Population ecology of paddlefish in the Keystone Reservoir System, Oklahoma. M.S. Thesis. Oklahoma State University, Stillwater. 136 pages. (paddlefish, population ecology)

Pender, D.R. 1998. Identifying factors leading to variable trout reproductive success in tailwater rivers. M.S. Thesis. University of Arkansas, Fayetteville. 146 pages.* (trout, regulated rivers, fish reproduction)

Perkins, A. 1999. Habitat use, reproductive biology and nest-site selection of ground-nesting birds at Freezeout Lake WMA in central Montana. M.S. Thesis. University of Montana, Missoula. 152 pages.* (bird ecology, ground-nesting birds, northern plains)

Perry, E.F. 1998. Clustered nesting of least flycatchers (*Empidonax minimus*) in north-central Minnesota. M.S. Thesis. University of Minnesota, St. Paul. 102 pages.* (reproduction, habitat)

Petrie, M.J. 1998. The role of interspecific competition in the decline of the black duck. Ph.D. Dissertation. University of Missouri–Columbia. 247 pages. (waterfowl, competition, black duck)

Piaskowski, R.M. 1998. Distribution and movements of northern squawfish and smallmouth bass during operation of a surface bypass and collection system for juvenile salmonids at Lower Granite Dam. M.S. Thesis. University of Idaho, Moscow. 64 pages. (predation, dams, squawfish)

Porter, M.A. 1999. Spatial relationships between mule deer and elk in south-central Wyoming. M.S. Thesis. University of Wyoming, Laramie.* (mule deer, elk, spatial relationship)

Puzo Driscoll, M.M. 1998. Ecological conditions affecting recruitment of largemouth bass in an oxbow of the lower Mississippi River. M.S. Thesis. Mississippi State University, Mississippi State. 66 pages. (oxbow lake, aquatic vegetation, yellow bass)

Quist, M.C. 1999. Structure and function of fish communities in streams on Fort Riley Military Reservation. M.S. Thesis. Kansas State University, Manhattan.* (freshwater fish communities, structure)

Rambo, R.D. 1998. Ozark stream fish assemblages and black bass population dynamics associated with watersheds of varying land use. M.S. Thesis. University of Arkansas, Fayetteville. 98 pages.* (warmwater streams, fish assemblages, land use)

Ras, L.B. 1999. Ecology and movements of nutria in a managed eastern shore marsh habitat. M.S. Thesis. University of Maryland Eastern Shore, Princess Anne.* (ecology, movements, nutria)

Renfrew, R. 1999. The influence of agricultural land use and physiography on grassland birds in the Wisconsin Driftless Area. M.S. Thesis. University of Wisconsin, Madison. 102 pages.* (grassland birds, driftless area, agriculture)

Rubin, D.J. 1999. Using satellite telemetry to determine seasonal movement and weather influence on flight altitude of turkey vultures to reduce strike hazards to military aircraft. M.S. Thesis. New Mexico State University, Las Cruces. 115 pages.* (turkey vulture, strike hazards, telemetry)

Schisler, G.J. 1999. Effects of environmental stressors on juvenile trout exposed to *Myxobolus cerebralis*. Ph.D. Dissertation. Colorado State University, Fort Collins. 126 pages.* (fish disease, environmental, *Myxobolus cerebralis*)

Schloeder, C. 1999. The effect of climate, landform, surface geology, and contemporary indigenous resource use on vegetation distribution and pattern in Omo National Park, Ethiopia. Ph.D. Dissertation. Utah State University, Logan. 196 pages.* (landscape ecology, landscape metrics, Africa)

Schmidt, S.L. 1999. Activity patterns of California leaf-nosed and other bats at wildlife water developments in the Sonoran Desert. M.S. Thesis. The University of Arizona, Tucson. 119 pages. (water developments, bat use, desert)

Simpson, T.D. 1998. Lake productivity indices as estimators of carrying capacity for burbot and northern pike in interior Alaska. M.S. Thesis. University of Alaska Fairbanks. 115 pages.* (burbot, northern pike, carrying capacity)

Skoloda, J. 1998. Population ecology of sora and Virginia rails at Horicon Marsh in Wisconsin. M.S. Thesis. University of Wisconsin, Madison. 98 pages.* (sora, Virginia rails, population ecology)

Stark, T.C. 1999. Spawning stocks and juvenile summer habitat of rainbow trout and steelhead, Gulkana River, Alaska. M.S. Thesis. University of Alaska Fairbanks. 119 pages.* (rainbow trout, steelhead, habitat)

Stiff, R.K. 1998. Factors affecting growth of Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) in alpine lakes of the Absaroka-Beartooth Wilderness, Montana. M.S. Thesis. Montana State University, Bozeman. 108 pages.* (Yellowstone cutthroat trout, alpine lakes, growth)

Tamayo, M. 1998. The watermilfoil weevil *Euhrychiopsis lecontei* in Washington State: distribution and factors influencing distribution. M.S. Thesis. University of Washington, Seattle. 89 pages.* (biological control, Eurasian watermilfoil, aquatic weevils)

Thomas, L.H. 1999. Breeding birds of a large-scale prairie restoration in Iowa: monitoring abundance and frequency of occurrence. M.S. Thesis. Iowa State University, Ames. 58 pages.* (grassland, prairie, nongame birds, restoration ecology)

Tims, J.L. 1999. Aspects of the nesting ecology and the effect of vegetation manipulations on herring gulls (*Larus argentatus*) and great black-backed gulls in Jamaica Bay, New York. M.S. Thesis. Cornell University, Ithaca, New York. 95 pages.* (habitat manipulation, gulls, ecology)

Trieu, P.L. 1999. Assessment of physicochemical and biological effects of two types of road surface on adjacent streams. M.S. Thesis. The Pennsylvania State University, University Park. 114 pages.* (runoff, unpaved roads)

Tydingco, T.A. 1999. The effects of timber harvest practices on fish habitat in Kenai Peninsula streams. M.S. Thesis. University of Alaska Fairbanks. 56 pages.* (logging, habitat, Kenai Peninsula)

Vacek, C.M. 1999. Effects of increasing lesser snow goose populations on shorebird foraging ecology at La Pérouse Bay, Manitoba. M.S. Thesis. South Dakota State University, Brookings. 79 pages. (habitat degradation, shorebirds, species richness)

VanderKooi, S.P. 1999. The effects of electroshock on immune function and disease progression in juvenile spring chinook salmon (*Oncorhynchus tshawytscha*). M.S. Thesis. Oregon State University, Corvallis. 50 pages.* (stress, electrofishing, disease, immune system, salmon)

Vogel, J.L. 1998. Reaction distances of salmonids, scaled to detection distances of SCUBA divers for use in a general piscivore foraging model. M.S. Thesis. Utah State University, Logan. 58 pages.* (salmonids, behavior, foraging model)

Vokoun, J.C. 1999. A sampling protocol for channel catfish in small to medium prairie streams of Missouri including notes on watershed level movements. M.S. Thesis. University of Missouri–Columbia. 113 pages. (Missouri, prairie streams, channel catfish, sampling protocol)

Walsh, M.G. 1999. Effects of implantation method and temperature on mortality and loss of simulated transmitters in hybrid striped bass. M.S. Thesis. Clemson University, Clemson, South Carolina. 27 pages.* (hybrid striped bass, transmitter, radio telemetry, implantation)

Walter, S.E. 1999. Nesting ecology of Eastern Prairie Population Canada Geese. Ph.D. Dissertation. University of Wisconsin, Madison. 204 pages.* (Canada geese, Eastern Prairie, nesting ecology)

Watson, B.M. 1999. Utilization of induced infestation and genetic techniques for the determination of host fishes for freshwater mussels, with emphasis on endangered species. M.S. Thesis. Virginia Tech, Blacksburg. 134 pages.* (mussels, genetics, fish hosts)

Wetteroff, K.L. 1998. Modeling and verifying predicted avian distributions in mid-Missouri. M.S. Thesis. University of Missouri–Columbia. 229 pages. (GAP analysis, habitat modeling, avian habitat)

Whitton, K.S. 1999. Habitat use of juvenile salmonids in Ophir and East Ophir creeks, Yakutat, Alaska. M.S. Thesis. Montana State University, Bozeman. 181 pages.* (habitat, coho salmon, sockeye salmon)

Winter, S.L. 1999. Vegetation and breeding bird communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado. M.S. Thesis. Kansas State University, Manhattan.* (black-tailed prairie dogs, grassland avifauna, prairie dog towns)

Woody, C.A. 1998. Ecological, morphological, and genetic life history of two sockeye salmon populations, Tustumena Lake, Alaska. Ph.D. Dissertation. University of Washington, Seattle. 117 pages.* (genetic sequencing, *Oncorhynchus nerka*, population ecology)

Yost, A.C. 1998. The effect of road traffic on moose, caribou, and grizzly bear distribution in Denali National Park and Preserve, Alaska. M.S. Thesis. University of Idaho, Moscow. 116 pages. (national parks, visitor wildlife interactions)

Zendt, J.S. 1999. Ecology of the salmonid whirling disease parasite and its aquatic oligochaete host in the Upper Colorado River Basin. M.S. Thesis. Colorado State University, Fort Collins. 37 pages.* (fish disease, whirling disease, parasite ecology)

Theses and Dissertations of Unit Affiliated Graduate Students

Ancell, M.E. 1998. Constructed wetlands for agricultural wastewater treatment. M.S. Thesis. Texas Tech University, Lubbock. 119 pages. (cattle, feedlot, wastewater treatment)

Azerrad, J.M. 1999. Avian community characteristics of urban greenspaces in St. Louis, Missouri. M.S. Thesis. University of Missouri–Columbia. 59 pages. (avian community, greenspace, urban habitats, St. Louis, Missouri)

Bierman, D. 1999. Sediment toxicity assessment of Lincoln Creek, Milwaukee, Wisconsin. M.S. Thesis. University of Wisconsin–Stevens Point. 109 pages.* (toxicity, sediment, urbanization)

Brown, D.K. 1998. Population viability analysis for Gila trout (Salmonidae: *Oncorhynchus gilae*), an endangered southwestern fish. M.S. Thesis. Oklahoma State University, Stillwater. 39 pages. (endangered trout, probability of extinction, modeling)

Budnik, J.M. 1999. Demography and factors influencing nesting success of Bell's vireos in grassland-shrub habitats. M.S. Thesis. University of Missouri–Columbia. 162 pages. (Bell's vireo ecology, nesting success)

Buler, J.J. 1998. A comparison of depredation at natural and artificial open-cup nests in a southern pine forest. M.S. Thesis. Louisiana State University, Baton Rouge. 45 pages. (depredation comparison, natural and artificial nests, pine forest)

Campbell, M.R. 1999. Everglades alligator holes: distribution and ecology. M.S. Thesis. University of Florida, Gainesville. 81 pages. (ecological feature, landscape)

Cherkiss, M.S. 1999. Status and distribution of the American crocodile (*Crocodylus acutus*) in southeastern Florida. M.S. Thesis. University of Florida, Gainesville. 34 pages. (American crocodile, status, distribution)

Conroy, C.J. 1998. Molecular phylogenetics of arvicoline rodents. Ph.D. Dissertation. University of Alaska Fairbanks. 167 pages.* (intraspecific variation, *Microtus*, phylogenetics)

Cubert, R.M. 1999. Digital objects in object-oriented physical multimodeling and simulation. Ph.D. Dissertation. University of Florida, Gainesville. 171 pages. (physical multimodeling, simulation)

Demboski, J.R. 1999. Molecular systematics and biogeography of long-tailed shrews (Insectivora: *Sorex*) and northern flying squirrels (Rodentia: *Glaucomys*). Ph.D. Dissertation. University of Alaska Fairbanks. 150 pages.* (*Sorex*, *Glaucomys*, biogeography)

Diebboll, R.A. 1999. Cattle grazing in wetlands on Alamosa/Monte Vista NWR. M.S. Thesis. University of Missouri–Columbia. 131 pages. (rest-rotation grazing, tall whitetop, habitat management)

Domansky, J. 1999. Infiltration and water quality impacts associated with wastewater ponds. M.S. Thesis. Texas Tech University, Lubbock. 77 pages. (cattle, feedlot industry, pond leaking, pollution)

Fairbairn, S.E. 1999. Local and landscape-level influences on wetland bird communities of the Prairie Pothole Region of Iowa. M.S. Thesis. Iowa State University, Ames. 101 pages.* (landscape ecology, prairie pothole region, waterfowl, nongame birds)

Fuller, C.M. 1998. Some effects of a timber harvest on the productivity of birds breeding in a Louisiana bottomland hardwood forest. M.S. Thesis. Louisiana State University, Baton Rouge. 70 pages. (timber harvest effects, bird productivity, southern hardwood forest)

Giorgi, K.S.H. 1999. Evaluation of ECOSEARCH: a wildlife-habitat model for predicting species occurrence. M.S. Thesis. University of Massachusetts, Amherst.* (habitat modeling, species occurrence)

Glasgow, K. 1999. Effects of river regulation by a water storage dam on invertebrate drift and on the growth of resident salmonids in western Washington. M.S. Thesis. University of Washington, Seattle. 120 pages.* (freshwater invertebrates, river ecology, trophic web)

Goguen, C.B. 1999. Brown-headed cowbird movements, habitat use, and impacts on hosts in a grazed and ungrazed landscape. Ph.D. Dissertation. University of Wisconsin, Madison. 124 pages.* (cowbird movements, habitat use, grazed, ungrazed landscapes)

Gooding, G. 1998. Nesting ecology and foraging behavior of yellow-throated warblers and northern parulas on Caddo Lake in Texas. M.S. Thesis. Louisiana State University, Baton Rouge. 71 pages. (warblers, foraging behavior, nesting ecology)

Grund, M.D. 1998. Movement patterns and habitat use of an urban white-tailed deer population in Bloomington, Minnesota. M.S. Thesis. University of Missouri–Columbia. 63 pages. (white-tailed deer, habitat, movements, urban deer)

Hallac, D.E. 1999. Conservation of unionid mussels threatened by zebra mussels (*Dreissena polymorpha*) in Lake Champlain, VT: an examination of species vulnerability, conservation strategies, and causal mechanisms of stress. M.S. Thesis. University of Vermont, Burlington. 110 pages. (mussel, conservation, invading species)

Haroldson, B.S. 1999. Evaluation of thermal infrared imaging for detection of white-tailed deer. M.S. Thesis. University of Missouri–Columbia. 49 pages. (infrared imaging, deer populations)

Hill, B.T. 1998. Development and utilization of procedures to monitor *E. coli* in constructed wetlands. M.S. Thesis. Texas Tech University, Lubbock. 84 pages. (wetlands, bacteria, microbiology)

Ihl, C. 1999. Comparative habitat and diet selection of muskoxen and reindeer on the Seward Peninsula, western Alaska. M.S. Thesis. University of Alaska Fairbanks. 81 pages.* (Alaska, muskoxen, reindeer)

Jensen, R.G. 1998. Maintaining savanna-shrub openings in Ozark oak-hickory forests. M.S. Thesis. University of Missouri–Columbia. 104 pages. (forest management, herbicides, habitati restoration)

Keech, M.A. 1999. Life-history consequences of maternal condition in Alaskan moose. M.S. Thesis. University of Alaska Fairbanks. 46 pages.* (Alaska, moose, reproductive success)

Lackovich, J.K. 1999. Studies of a viral etiology for fibropapillomatosis of the green turtle, *Chelonia mydas*, and the loggerhead turtle, *Caretta caretta*. M.S. Thesis. University of Florida, Gainesville. 44 pages. (green turtle, loggerhead turtle, diseases)

Lawson, L.L. 1999. Epilithic diatoms as indicators of stream condition in arid lotic ecosystems of the American Southwest. Ph.D. Dissertation. The University of Arizona, Tucson. 346 pages. (diatoms, stream condition, indicators)

Lind, J.W. 1998. A comparison of forest edge and interior habitat with data from natural and artificial songbird nests. M.S. Thesis. Louisiana State University, Baton Rouge. 50 pages. (songbirds, nesting habitat, natural and artificial nests)

Major, W., III. 1999. Double-crested cormorant (*Phalacrocorax auritus*) abundance and foraging pressure as a response to differing rainbow trout (*Oncorhynchus mykiss*) management strategies on inland lakes in eastern Washington State. M.S. Thesis. Washington State University, Pullman.* (avian behavior, cormorant, stocking, salmonids)

Mallek, E.J. 1999. Plant architecture and forage selection by moose. M.S. Thesis. University of Alaska Fairbanks. 63 pages.* (*Salix* spp., moose habitat, plant architecture)

Mantooth, S.J. 1999. Molecular systematics of *Dipodomys elator*. M.S. Thesis. Texas Tech University, Lubbock. 78 pages. (small mammals, vertebrates, *Dipodomys*, genetics)

Naughton, G.P. 1998. Predator abundance and salmonid prey consumption in the tailrace and forebay of Lower Granite Dam and the upper arms of Lower Granite Reservoir. M.S. Thesis. University of Idaho, Moscow. 130 pages. (predation, smallmouth bass, tailrace, forebay, Snake River)

Nelle, P.J. 1998. The long-term effect of fire on sage grouse nesting and brood-rearing habitats on the Upper Snake River Plain. M.S. Thesis. University of Idaho, Moscow. 85 pages. (prescribed burns, sage grouse, Snake River)

Newby, J. 1999. Angler catch rates and factors affecting growth of walleye in Escanaba Lake, Vilas County, Wisconsin. M.S. Thesis. University of Wisconsin–Stevens Point. 121 pages.* (walleye, growth, exploitation)

Pagen, R.W. 1999. Breeding and post-breeding habitat use and detectability of songbirds in the Missouri Ozarks. M.S. Thesis. University of Missouri–Columbia. 98 pages. (songbirds, Missouri Ozarks, breeding, habitat use)

Patterson, M.A. 1998. Energy reserves in native freshwater mussels (Bivalvia: Unionidae) with and without attached zebra mussels: effects of food deprivation. M.S. Thesis. Virginia Tech, Blacksburg. 59 pages.* (exotic species, energetics, food deprivation, zebra mussels)

Puschock, J.E. 1998. Route selection and stopover behavior of selected passerine species in south-central New Mexico. M.S. Thesis. New Mexico State University, Las Cruces. 44 pages.* (migrant birds, habitat, New Mexico)

Raedeke, A.H. 1998. Human dimensions of ecosystem management. M.S. Thesis. University of Missouri–Columbia. 82 pages. (human dimensions, ecosystem management, land owner programs)

Rodrick, P.J. 1999. Morphological, genetic and den site characteristics of the kit fox (*Vulpen macrotis*) on McGregor Range in south central New Mexico. M.S. Thesis. University of Wisconsin, Madison. 77 pages.* (kit fox, genetics, morphology, New Mexico)

Saunders, T. 1999. Habitat availability, dietary mineral supplement, and measuring abundance of band-tailed pigeons in western Oregon. Ph.D. Dissertation. Oregon State University, Corvallis. 133 pages.* (band-tailed pigeons, habitat abundance, mineral supplement)

Schmalz, P.J. 1999. Movements of adult lake trout tagged in northwestern Lake Michigan. M.S. Thesis. University of Wisconsin–Stevens Point. 67 pages.* (lake trout, movement, Lake Michigan)

Swan, D.E. 1999. Evaluating approaches for monitoring terrestrial vertebrates in U.S. national parks: an example from Tonto National Monument, Arizona. M.S. Thesis. The University of Arizona, Tucson. 175 pages. (monitoring, terrestrial vertebrates, approaches)

Tiemann-Boege, I. 1999. Molecular systematics of the *Peromyscus boylii* species group. M.S. Thesis. Texas Tech University, Lubbock. 115 pages. (small mammals, *Peromyscus*, vertebrates, genetics)

Tomson, S.D. 1999. Ecology and summer/fall habitat selection of American marten in northern Idaho. M.S. Thesis. University of Montana, Missoula. 73 pages.* (seasonal habitat selection, *Martes americana*)

Unmuth, J.M.L. 1998. Effects of aquatic plant manipulation on angling and fish in Fish Lake, Dane County, Wisconsin. M.S. Thesis. University of Wisconsin–Stevens Point. 76 pages.* (macrophytes, plant control, angling)

Wall, M.A. 1999. Nickel accumulation in serpentine arthropods with emphasis on *Melanotrichus boydi* (Heteroptera: Miridae). M.S. Thesis. Auburn University, Auburn, Alabama. 47 pages. (arthropods, *Melanotrichus boydi*, heavy metals)

Williams, A. 1999. Landscape and habitat influences on small mammal assemblages in lower Missouri River floodplain forests. M.S. Thesis. University of Missouri–Columbia. 98 pages. (Missouri River, small mammals, floodplain forests)

Xia, J. 1999. Constructed wetlands for wastewater treatment. M.S. Report. Texas Tech University, Lubbock. 110 pages. (nitrogen, wastewater, wetlands)

Scientific Publications of Non-Student Affiliates

Bass, A.L., C.J. Lagueux, and B.W. Bowen. 1998. Origin of green turtles, *Chelonia mydas*, at "Sleeping Rocks" off the Northeast Coast of Nicaragua. Copeia 4:1064–1069. (sea turtles, nesting colony, mark-recapture studies)

Beets, J., and A. Friedlander. 1999. Evaluation of a conservation strategy: a spawning aggregation closure for red hind, *Epinephelus guttatus* in the U.S. Virgin Islands. Environmental Biology of Fishes 55:91–98.* (groupers, management, recovery, reef fish)

Bennetts, R.E., W.A. Link, J.R. Sauer, and P.W. Sykes, Jr. 1999. Factors influencing counts in an annual survey of snail kites in Florida. The Auk 116(2):316–323. (endangered species, modeled population change, detection rates)

Blums, P., J.B. Davis, S.E. Stephens, A. Mednis, and D.M. Richardson. 1999. Evaluation of a plasticine-filled leg band for day-old ducklings. Journal of Wildlife Management 63(2):656–663. (band retention, survival, wood duck)

Blundell, G.M., J.W. Kern, R.T. Bowyer, and L.K. Duffy. 1999. Capturing river otters: a comparison of Hancock and leg-hold traps. Wildlife Society Bulletin 27(1):184–192. (Alaska, capture, efficiency, trap comparison)

Bohall-Wood, P., M.W. Collopy, and C.M. Sekerak. 1998. Post-fledgling nest dependence period for bald eagles in Florida. Journal of Wildlife Management 62(2):333–339. (nest dependency, postfledging, bald eagles)

Bonner, T.H., T.M. Brandt, J.N. Fries, and B.G. Whiteside. 1998. Effects of temperature on egg production and early life stages of the fountain darter. Transactions of the American Fisheries Society 127:971–978. (aquatic, larval survival, water temperature)

Borkhataria, R.R. 1998. Roseate tern recovery: progress and challenges. Endangered Species Bulletin 23(5):26–27.* (endangered species, roseate tern)

Britten, M.W., P.L. Kennedy, and S. Ambrose. 1999. Performance and accuracy evaluation of small satellite transmitters. Journal of Wildlife Management 63(4):1349–1358. (American peregrine falcon, location accuracy, migration)

Brown, J.J., E.P. Glenn, K.M. Fitzsimmons, and S.E. Smith. 1999. Halophytes for the treatment of saline aquaculure effluent. Aquaculture 175:255–268. (saline aquaculture effluent, treatment, halophytes)

Buford, E.W., and D.E. Capen. 1999. Abundance and productivity of forest songbirds in a managed, unfragmented landscape in Vermont. Journal of Wildlife Management 63(1):180–188. (brood density, distance sampling, Neotropical migrants)

Burhans, D.E., and F.R. Thompson III. 1998. Effects of time and nest-site characteristics on concealment of songbird nests. The Condor 100:663–672. (brood parasitism, nest concealment, nest predation)

Burhans, D.E., and F.R. Thompson III. 1999. Habitat patch size and nesting success of yellow-breasted chats. Wilson Bulletin 111(2):210–215. (yellow-breasted chat, habitat patch size, nesting success)

Carter, S.K., F.C.W. Rosas, A.B. Cooper, and A.C. Cordeiro-Duarte. 1999. Consumption rate, food preferences and transit time of captive giant otters *Pteronura brasiliensis*: implications for the study of wild populations. Aquatic Mammals 25(2):70–90. (marine mammals, transitmtimes, food preferences, scat analysis)

Clark, W.R., and T.R. Bogenschutz. 1999. Grassland habitat and reproductive success of ring-necked pheasants in northern Iowa. Journal of Field Ornithology 70(3):380–392. (habitat use, pheasants, CRP)

Clark, W.R., R.A. Schmitz, and T.R. Bogenschutz. 1999. Site selection and nest success of ring-necked pheasants as a function of location in Iowa landscapes. Journal of Wildlife Management 63(3):976–989. (habitat use, reproductive success, pheasants)

Conroy, C.J., and J.A. Cook. 1999. MtDNA evidence for repeated pulses of speciation within arvicoline and murid rodents. Journal of Mammalian Evolution 6(3):221–245. (vole, murids, parsimony, molecular clock)

Coppedge, B.R., and J.H. Shaw. 1998. Diets of bison social groups on tallgrass prairie in Oklahoma. The Prairie Naturalist 30(1):29–36. (*Bos bison*, social segregation, food habits)

Curson, D., C.B. Goguen, and N.E. Mathews. 1998. Western wood-peewees accept cowbird eggs. Great Basin Naturalist 58:90–91.* (wood-pewees, cowbird eggs, nest parasitism)

Cutler, T.L., and M.L. Morrison. 1998. Habitat use by small vertebrates at two water developments in southwestern Arizona. The Southwestern Naturalist 43(2):155–162. (water developments, habitat use, small vertebrates)

Davis, M.F., T.B. Gurung, B. Shrestha, S.B. Jones, G.D. Wylie, B.D. Perkins, and J. R. Jones. 1998. Use of a subsurface plankton layer to benefit a cage-culture fishery in Lake Phewa, Nepal. Verhandlungen Internationale Vereingung für Theoretische und Angewandte Limnologie 26:2220–2227. (algae, fish culture, aquaculture, metalimnetic algal peak)

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Delany, M.F., P.B. Walsh, B. Pranty, and D.W. Perkins. 1999. A previously unknown population of Florida grasshopper sparrows on Avon Park Air Force Range. Florida Field Naturalist 27(2):52–56. (endangered species, grassland birds, disturbance)

Demboski, J.R., B.K. Jacobsen, and J.A. Cook. 1998. Implications of cytochrome *b* sequence variation for biogeography and conservation of the northern flying squirrels (*Glaucomys sabrinus*) of the

Alexander Archipelago, Alaska. Canadian Journal of Zoology 76:1771–1777. (Alaska, flying squirrel, intraspecific variation)

Dinsmore, J.J., S.J. Dinsmore, and D.L. Howell. 1999. Least terns and piping plovers in Iowa: persistence of marginal populations. Pages 51–55 *in* K.F. Higgins, M.R. Brashier, and C.D. Kruse, editors. Piping plovers and least terns of the Great Plains and nearby. South Dakota State University, Brookings. (plovers, shore birds, Iowa, terns, population ecology)

Dreitz, V.J., and M.R. Shannon. 1998. The occurrence of snail kite nests with four fledglings in Florida. Florida Field Naturalist 26(4):122–123. (endangered species, nest monitoring, clutch size)

Dudley, R.K., and W.J. Matter. 1999. Effects of a record flood on fishes in Sabino Creek, Arizona. The Southwestern Naturalist 44(2):218–221. (flood effects, fishes, distribution and abundance)

Duffy, L.K., M.K. Hecker, G.M. Blundell, and R.T. Bowyer. 1999. An analysis of the fur of river otters in Prince William Sound, Alaska: oil related hydrocarbons 8 years after the *Exxon Valdez* oil spill. Polar Biology 21:56–58. (river otters, hydrocarbons, oil pollution)

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Echelle, A.A., and A.F. Echelle. 1998. Evolutionary relationships of pupfishes in the *Cyprinodon eximius* complex (Atherinomorpha: Cyprinodontiformes). Copeia 1998(4):852–865. (Mexico, pupfishes, allozymes)

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Feirer, S.T., and R.S. Shepperd. 1999. First nesting record of the tricolored heron for Oklahoma. Bulletin of the Oklahoma Ornithological Society 32(1):4–5. (*Egretta tricolor*, breeding range expansion)

Gammonley, J.H., and L.H. Fredrickson. 1998. Breeding duck populations and productivity on montane wetlands in Arizona. Southwestern Naturalist 43(2):219–227. (Arizona, breeding ducks, montane wetlands)

Gehrt, S.D., and E.K. Fritzell. 1999. Behavioural aspects of the raccoon mating system: determinants of consortship success. Animal Behaviour 57(3):593–601. (raccoon, mammalian courtship, behavior)

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George, J.C., and R.S. Suydam. 1998. Observations of killer whale (*Orcinus orca*) predation in the northeastern Chukchi and western Beaufort seas. Marine Mammal Science 14(2):330–332. (grey whale, *Orcinus orca*, predation, subsistence hunting)

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Gould, W.R., and J.D. Nichols. 1998. Estimation of temporal variability of survival in animal populations. Ecology 79(7):2531–2538. (temporal variance, estimation, survival)

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The Cooperative Fish and Wildlife Research Units Program would like to thank each of the cooperators below for their continued support:

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